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A BENCHMARK OF  
VEHICLE MAINTENANCE TRAINING  
BETWEEN THE U.S. AIR FORCE  
AND A CIVILIAN INDUSTRY LEADER

THESIS

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THE U.S. AIR FORCE AND A CIVILIAN INDUSTRY LEADER

THESIS

Presented to the Faculty of the School of Systems  
and Logistics of the Air Force Institute of Technology  
Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Logistics Management

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Abstract

This thesis compared vehicle maintenance training between the U.S. Air Force (USAF) and a leading civilian automotive training organization, Cuyahoga Valley Joint Vocational School (CVJVS), using a comparative analysis technique known as benchmarking. First, the study identified how the USAF and civilian automotive training industries conduct training. Next, the researchers identified common areas for comparison between training programs. Then the industry leader's best practice was identified. The best practice at CVJVS was the National Automotive Technicians Education Foundation (NATEF) certification process. In applying this practice at Chanute, the researchers identified three deficient areas, or negative gaps. The first gap was in the number of hours of instruction. USAF apprentice general purpose mechanics receive 443 hours of instruction, and the NATEF standard requires a minimum of 1,080 instructional hours. The second gap was the lack of high priority curriculum tasks included in Chanute's plan of instruction. The third gap was in Chanute's infrequency of returning instructors to the automotive industry for update training. Finally, three further findings were revealed. Chanute's acquisition process of vehicle trainers has not provided the latest vehicle technology. Chanute's advisory

committee, the Utilization and Training Workshop, does not convene often enough to ensure the USAF vehicle maintenance community's best interests are addressed in a timely manner. Finally, Chanute has applied computer-based instruction and distance-learning to an extent not observed at other civilian training organizations.

A BENCHMARK OF VEHICLE MAINTENANCE TRAINING  
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I. Introduction

Background

According to Brigadier General Charles C. Barnhill,  
Director of Transportation, HQ USAF,

A comprehensive training program that provides  
the officer and enlisted force the necessary  
skills to execute the mission is absolutely  
essential. (5:4)

And to this end, quality training produces quality people  
(60:5). Quality training will continue to be a top  
priority, even among a continued presence of austere  
budgets. The challenge in an environment of reductions is  
to keep the quality of training and training products up to  
standards while using fewer resources (25:56).

Technological advances may well be the bridge that spans  
the gap between training requirements and shrinking  
training dollars.

The Air Force transportation community with its  
"Excellence in Training" motto, in conjunction with U.S.  
industry, must push technology forward to capitalize on  
advances that will lead to accelerated, lower cost systems  
development (66:52).

## General Issue

Vehicle maintenance training has been in the spotlight ever since the first graduating class from F.E. Warren Air Force Base (AFB), Wyoming in 1949 (57:2). Since that first graduating class of Air Force vehicle mechanics, the customers of the training establishment (the Air Force transportation community) have actively sought to improve the quality of the apprentice-level technician.

This issue of quality, or competence, of newly trained mechanics has consistently permeated senior officer and enlisted discussions. The annual assemblies of the Transportation Training Advisory Group (TTAG) and Enlisted Training Advisory Group (ETAG) have shared operational concerns about receiving ill-prepared mechanics for duty upon graduation from formal training (58).

Perhaps the most controversial issue to plague current vehicle maintenance training was in 1984. A segment of the resident technical training for special purpose mechanics was downgraded from category A (100 percent of accessions received residential training) to category B (fifty percent of accessions received residential training, fifty percent directly assigned to base with no training). This action placed fifty percent of the entire entry-level training effort on the operational bases for this most critically skilled mechanic. Needless to say, vehicle maintenance training has been a "hot topic of contention" (57:2).

To this end, General Merrill A. McPeak, Air Force Chief of Staff, has challenged the entire Air Force training community to a complete quality review (62:14). He has pronounced 1992 as the "year of training" and has ordered a systematic Air Force-wide review of both the learning process and support structure. This shake up of the training process can be likened to a quality review. Since the mid-1980s, the Air Force has adopted quality reviews as part of a significant self-improvement mechanism known as Total Quality Management (TQM). Benchmarking, one TQM tool, is the continuous process of measuring one organization's product or service against the top competition or leader in the field. Benchmarking is promoted through the Federal Quality Institution at the federal level, and within the Air Force, through the Air Force Logistics Command's (AFLC) Command Quality Council (7).

The earliest effort to explore the usefulness of civilian training to the military was in 1982. Since that time, there have been few attempts to bridge the information gap between civilian and military training, of which pre-enlistment recruitment training (PERT) is the latest effort. PERT is an effort to civilianize military training, whereas this thesis is an effort to discover what contributions the military might have to offer civilian industry, or vice versa.

### Specific Problem

Through the use of a TQM tool, benchmarking, how does the Air Force vehicle maintenance training program compare to a leading civilian automotive training organization?

### Investigative Questions

1. How does the Air Force conduct vehicle maintenance training?
2. How does the civilian industry conduct automotive training?
3. What areas should be benchmarked in automotive training? (Benchmarking step one)
4. Who are leading comparative civilian automotive training organizations? (Benchmarking step two)
5. What is the best method to execute the benchmark and gather the comparative data? (Benchmarking step three)
6. What is the "gap," or measure of difference, between the Air Force and the leading civilian organization? (Benchmarking step four)

### Scope

The scope of this research, from a military aspect, is confined to entry-level enlisted general-purpose vehicle maintenance personnel. The benchmarked industry will focus primarily on the automotive manufacturing and training institutions. The benchmarking process includes ten steps (9:17), of which this thesis will address the first four steps. The purpose is to determine if an information gap exists, not to correct it. Benchmarking steps five through ten are corrective measures, which are beyond the scope of this thesis.

Additionally, it is recognized that the industry's training needs are different. The exact nature of differences is unknown. Furthermore, it is not known how much a contribution of a benchmark of civilian training would actually produce to the overall automotive training effort. Nevertheless, it appears there are common areas of interest, like instructor qualifications, curricula, training aids, etc., that could be shared. Thus, it is the potential for expanded learning and sharing of information that forms the foundation for this thesis.

### Overview

The following chapter reviews the importance of training, and focuses on vehicle maintenance training literature on the Air Force and industry. The literature review also presents a discussion on benchmarking. Chapter III discusses the research methodology used to answer each investigative question, and Chapter IV presents the researchers' findings on each investigative question. The final chapter is a conclusion of this research study, with recommendations for future research.

## II. Literature Review

This chapter reviews literature on the topic of training. A discussion of training and its importance establishes the foundation for the remainder of this thesis. Following the introduction of training, this review specifically looks at implementation of vehicle maintenance training in the Air Force and in the civilian sector.

A literature review of benchmarking, a TQM tool, is also presented. Benchmarking is a continuous process of measuring an organization's products, services, and practices against other firms recognized as industry leaders (9:248). The literature supporting training and benchmarking is discussed in detail in this chapter.

The research included a review of books and periodicals through the computer disk read-only memory. Also, a Defense Technical Information Center search was conducted, and pertinent documents were obtained.

### Introduction

Training is defined at the broadest level as "development of a particular skill or group of skills" (61:2424). It is a vital process which ensures that personnel, whether military or civilian, can perform their assigned duties proficiently. However, training is a

continuous process in an ever-changing world. An era of new technology, limited resources, and dynamic world politics establishes the need for training to be updated constantly. According to U.S. Army General John W. Foss,

We will not have enough resources to keep doing everything we have done in the past. The challenge of the reductions will be to keep the quality of our training and training products up to standard while using fewer resources. (25:56)

If an organization does not maintain its training to keep abreast of changes, it cannot survive in today's competitive society.

#### Vehicle Maintenance Training in the Air Force

Vehicle maintenance training in the Air Force is conducted at two levels. First, formal training is conducted at Chanute AFB; then follow-on training is performed at the base-level. These training credits can be applied to an associate degree through the Community College of the Air Force (CCAF).

#### Automotive Technology Division, Chanute AFB, Illinois.

Vehicle maintenance training for the Air Force is conducted by the 3340th Technical Training Group, Automotive Technology Division, at Chanute AFB, Illinois. It is responsible for providing the formal vehicle maintenance training for the Air Force, with the exception of vehicle bodywork and maintenance control and analysis; the training for these two specialties is conducted at

Aberdeen Proving Grounds, Maryland, and Lowry AFB, Colorado, respectively (50:1).

The division's mission is to provide technical training in vehicle maintenance to over 1,500 students annually, using training resources of 328 custom-built training devices and sixty-six vehicles worth over \$4 million (39:33). The division provides four Air Force Specialty Code (AFSC) awarding courses and specialized advanced classes, both in residence and by mobile training teams (50:1).

The Air Force initially trains a vehicle mechanic to become an apprentice. An entry-level Air Force vehicle mechanic is awarded a three-level proficiency rating. The four basic AFSC-awarding courses taught at the Automotive Technology Division are:

- (1) Apprentice General Purpose Vehicle Mechanic  
(47232)
- (2) Apprentice Special Vehicle Mechanic (Crash/Fire  
Vehicles) (47231A)
- (3) Apprentice Special Vehicle (Refueling) Mechanic  
(47231B)
- (4) Apprentice Special Purpose and Equipment Mechanic  
(47230) (50:5)

Subsequently, apprentice vehicle mechanics can upgrade their skill levels through career development courses (CDC's) and advanced vehicle maintenance courses offered in residence at Chanute, or through mobile maintenance training teams.

There are nine different advanced courses offered at Chanute, which allow mechanics to stay abreast of technological changes, as well as upgrade their skill level (50:6). Chanute's mobile training teams offer instruction in twelve different courses (50:7). Vehicle mechanics usually attend some of these within the first three to six years in their Air Force career.

According to Captain Paul Schikora, chief of the Automotive Technology Division, Chanute's mechanism to update its training curriculum is through the Utilization and Training Workshop (U&TW). Composed of vehicle maintenance experts from the Air Force major commands, the U&TW is responsible for giving guidance on what should be trained at Chanute and on the job. Over the past eight years, the U&TW has met twice -- once in 1984, and once in 1992. The infrequency of the U&TW meetings is due to the enormous amount of preparation time and costs. For example, prior to the U&TW meeting, occupational survey reports (OSR) must be completed by technicians in the field. This inventory of tasks must be analyzed, and the results must be compiled in preparation for the U&TW (52).

In addition to the U&TW, Chanute receives inputs from its customers through the Training Evaluation Reports (TER) and Training Quality Reports (TQR). TER's are reports sent from Chanute's group headquarters to the supervisors of newly graduated vehicle mechanics. The TER's contain

detailed questions on the course material taught at Chanute, and on the usefulness of the training. TQR's are reports sent from the customers (i.e., supervisors or graduates) to Chanute's group headquarters. This feedback mechanism identifies training deficiencies of mechanics (24).

Base-Level Vehicle Maintenance Training. Specific guidance for vehicle maintenance training at the base-level in the Air Force is outlined in Air Force Manual (AFM) 77-310, Volume II, "Vehicle Maintenance Management," Chapter 5. It states that "The successful operation of Air Force maintenance shops depends on the knowledge of the assigned people and how well they do their jobs" (19:68). This regulation requires that each vehicle maintenance shop have an assigned functional area training monitor (19:68), which further reflects the importance the Air Force places on training. "Our charter for the Air Force is to maintain the fleet that is vital to supporting every mission we have" (57:2).

Community College of the Air Force. The Community College of the Air Force (CCAF) is ". . . the only federally chartered military institution in the United States that awards college degrees solely to USAF enlisted personnel" (14:I-1). The technical training and on-the-job upgrade training learned in the Air Force are translated by

the CCAF into college-level semester hours. The CCAF is accredited by the Southern Association of Colleges and Schools (14:I-1).

Through the CCAF, a vehicle mechanic can receive an Associate in Applied Science Degree in Logistics and Resources upon completion of sixty-four semester hours:

	<u>Semester Hours</u>
Overall Requirements	
Technical Education	24
Leadership, Management, and Military Studies	6
Physical Education	4
General Education	15
Program Electives	<u>15</u>
Total Semester Hours Required	64
(14:II-73)	

Based on the scope defined in Chapter I, the following analysis focuses on the general purpose mechanic. When vehicle mechanics complete the fifty-seven day Apprentice General Purpose course at Chanute, they are accredited with nineteen semester credit hours through the CCAF. These nineteen hours are applicable towards the "Technical Education" requirement of obtaining the Associate in Applied Science Degree in Logistics and Resources.

	<u>Semester Hours</u>
Apprentice General Purpose Vehicle Mechanic	
Automotive Air Conditioning	1
Combustion Engines	4
Brakes/Suspension Systems	2
Power Train Fundamentals	4
Automotive Electrical System Principles	2
Diesel Engine Maintenance	3
Overview of Vehicle Maintenance	<u>3</u>
	19
(13:10-11)	

If apprentice vehicle mechanics subsequently completed all the applicable advanced courses offered through Chanute, they would receive credit for an additional thirteen semester hours which could also be applied towards a CCAF degree. The sum of the initial apprentice course and the advanced courses is thirty-two hours, plus an additional eight hours are available by upgrading through the five and seven-level skill levels as part of CCAF internship requirements. This exceeds the thirty-nine semester hour requirement by one hour.

Technical CCAF Degree Requirements	Semester Hours
Technical Education	24
Program Electives	<u>15</u>
	39

(14:II-73)

General Purpose Vehicle Mechanic Training	
Initial Apprentice Training	19
Advanced Courses	13
Internship	<u>8</u>
Total Hours Accumulated, Technical Education	40

(13:10-11)

Current Issues. The directors of transportation from all major commands convened at the TTAG meeting on 14 June 1991, and collectively expressed great concern about the future of vehicle maintenance training in the Air Force (33). The TTAG tasked Colonel Alvin S. Swanson, Commander of the Joint Personal Property Shipment Office - COS, to examine options for vehicle maintenance technical

training. Colonel Swanson's report discusses his findings and identifies seven issues:

(1) Priority training (category A) for special purpose mechanics must be restored.

(2) ATC is unable to keep abreast of changing technology.

(3) There is a great deal of uncertainty caused by Chanute and Lowry closures.

(4) There is a need for more short courses.

(5) There is a need to expand training flexibility through the use of civilian institutions and other means.

(6) There is apprehension concerning contracting training.

(7) There is a lack of understanding of the Interservice Training Review Organization (ITRO). (57:1)

Closure of Chanute AFB. Chanute AFB is scheduled to close in April 1993. The Automotive Technology Division was originally planned to move to Lowry AFB, Colorado; however, Lowry AFB has since been selected for closure, too. The current plan is to move the division to Lackland AFB, Texas, where it will combine with other transportation training functions. The new transportation training facility is scheduled to be ready for use in April 1995 (57:30). Anticipating the two year transition time from Chanute AFB to Lackland AFB, the Automotive Technology Division is going to increase its student enrollment (51).

Interservice Training Review Organization (ITRO).

A specific issue currently being considered is the task of

the ITRO. "ITRO is a voluntary organization of representatives from the Army, Air Force, Navy, Marine Corps and Coast Guard formed to reduce cost by training jointly" (57:Tab I). The ITRO determines the feasibility of combining training among the DOD service branches. In September 1991, the ITRO conducted a study on combining Air Force and Army vehicle mechanic training at Aberdeen Proving Grounds, Maryland (24). However, this proposal was deemed infeasible in February 1992 due to lack of resource availability. Currently, ITRO is conducting a study on combining Air Force and Navy vehicle mechanic training at the Gulfport Naval Training Center, Gulfport, Mississippi (48).

Pre-enlistment Recruitment Training (PERT). A one-year study was conducted by ATC to determine the possibility of recruiting personnel who are trained in their specialty prior to enlisting in the Air Force. The study of pre-enlistment recruitment training (PERT) specifically analyzed three AFSC's: Communication Computer Systems Controller, Dental Specialist, and General Purpose Vehicle Mechanic. The PERT study finding ". . . revealed that pre-accession training could produce cost and manpower savings" (57:Tab H). The PERT program is currently being analyzed by Congress (48).

USAF Use of Civilian Training. There are some manufacturers and dealers in the civilian industry who offer a variety of vehicle specific training courses in which the Air Force participates, often times at no charge (57:37). AFM 77-310, Volume II, states that there are "Many excellent training courses available from commercial sources" (19:69). The Automotive Technology Division at Chanute AFB sends its instructors to attend these courses (24), and base-level maintenance shops, such as Wright-Patterson AFB, send their mechanics to these training opportunities (26). Overall, there are some areas of compatibility, beyond entry-level training, in which the Air Force and industry train together.

The importance of training in the Air Force will become further amplified as fewer resources and a more peaceful world environment create the need for manpower cuts.

#### Vehicle Maintenance Training in the Civilian Industry

The importance of training is also recognized in the civilian automotive repair sector. "A technical education and training system is necessary to upgrade employee skills in order to keep pace with technological change" (12:18). A review of various brochures and catalogs from automobile dealers and special equipment manufacturers reveals an on-going effort to keep vehicle mechanics trained on the most current, state-of-the-art vehicles and equipment

(57:71-139). "The continuous integration of new technologies with more highly skilled labor is the true engine of American competitiveness" (12:18).

Civilian automotive training needs are addressed in three general areas: manufacturers' programs, public and private training institutions, and program certifiers. All three agencies do not act independently. Rather, they are interwoven, and serve as complements.

Original Vehicle Manufacturer Training. Original vehicle manufacturer training is divided into two general areas: cooperative apprenticeships and workshops.

Cooperative Apprenticeships. The automotive industry's most pronounced training effort comes in the form of cooperative apprenticeships. The concept links community colleges and secondary vocational technical schools with local dealers. The cooperative idea was originally begun by the National Automobile Dealers' Association (NADA), and since the early 1970s, most major automakers have set up their own programs (10:26).

For example, General Motors' (GM) Automotive Service Educational Program (ASEP) will be reviewed. However, other manufacturers have developed similar programs:

- (1) Ford Motor Co.: Automotive Student Service Training (ASSET)
- (2) Chrysler Motor Corp.: Chrysler Apprenticeship Program (CAP)

- (3) Nissan Motor Corp.: Professional Cooperative Apprenticeship Program (PROCAP)
- (4) Toyota Motor Corp.: Toyota Technical Training Network (T-TEN) (65)

GM's ASEP is a two-year automotive program that leads to an Associate Degree in Automotive Technology. The course curriculum is developed by both the school and GM, but is heavily oriented towards manufacturer's desires. The associate degree curriculum is completed over the duration of seven quarters, averaging sixteen credit hours per quarter.

	<u>Credit Hours</u>
Core Automotive Courses, GM systems only	53
Cooperative Work at GM Dealership	21
General Education	<u>36</u>
Total Quarter Credit Hours	110

Students attend class or laboratory at the school for a six to ten week period, then rotate for an equal amount of time to a local GM dealership service department. While at the dealership, the student's work experience closely parallels the course materials. Participating dealers match a supervisor to the apprentice and rotate the student into different jobs at the shop. The entire program lasts eighty to ninety weeks with equal time split between the school and dealer. Under GM's program, the student is responsible for all tuition and fees. Other manufacturers and local dealers may provide financial assistance. The

apprenticeship program is popular among community colleges, and offers the schools many advantages (28:8-9).

The National Association of College Automotive Teachers (NACAT) estimates that there are 500 community colleges operating cooperative programs (10:28). For example, Sinclair Community College of Dayton, Ohio, has cooperative agreements with GM and Nissan. According to Mr. James Halderman, Professor of Automotive Technology at Sinclair, the cooperative relationships provide:

- (1) A continuous source of students;
- (2) Donations of equipment, training aids, and materials;
- (3) Latest technology from original vehicle manufacturers; and
- (4) Training and development seminars for college instructors. (30)

Workshops. In addition to the community college associate degree cooperative programs, most automobile manufacturers operate dedicated training centers and satellite service training centers. These training centers offer short-term workshops, which are after-market, non-credit programs that vary in length from one to fourteen days. They are geared toward the fully-qualified technician seeking update training on the latest technology.

Also, there are numerous private training companies that provide training on specific automotive systems. For

example, Industrial Training Services (ITS) of Billingham, Washington, offers a short course in anti-lock brake systems (57:Tab D).

Public and Private Training Institutions. Most U.S. cities with a population of about 20,000 have access to a community college, vocational technical school, or private trade school, most of which offer some form of automotive training (57:38).

Community Colleges. A typical community college offers two-year applied sciences associate degree programs in automotive technology, or non-degree, but certified, programs.

According Mr. Halderman at Sinclair, the two-year associate degree provides entry-level, skilled mechanics for the service market. Graduates typically find employment with existing dealerships, independent service garages, automotive machine shops, or large fleet equipment companies. Also, the associate degree provides a springboard into a four-year bachelor of science degree in automotive technology management. On the other hand, the certification-only program meets the retraining and career advancement needs of individuals already in the repair field (30).

Vocational Technical Schools. Most school district and state-funded vocational technical schools also

provide some degree of automotive training. As compared to community college programs, vocational technical schools typically offer non-degree curricula that are geared toward either senior high school students, or adults seeking retraining or career advancement. A typical high school student spends half the day at a regular high school, and half the day at a vocational technical automotive laboratory. Also, during the latter half of the senior year, students have the opportunity to work at a local automobile dealership or garage, as part of an internship program. The training emphasis at vocational technical schools is more technical "hands-on" training, and less post-secondary general education (4).

Private Institutions. According to the Career College Association (CCA), a major accreditor of private training institutions, there are over sixty different nationwide and regional private technician training institutions. These schools provide training to students to become automotive service technicians. These programs range from short-term certification to full-time degree awarding programs. A typical full-time automotive program runs twenty to twenty-four months in length, and awards the graduates with an Associate of Applied Science Degree (11:1-6).

Much like the vocational technical schools, private technical institutes almost exclusively devote their

curricula to applied automotive training through extensive "hands-on" laboratory learning, according to Mr. James Stanwood, Chief Automotive Instructor at ITT Technical Institute. Theory of basic automotive sciences are introduced (e.g., electrical, hydraulic systems), but provide less lecture time than a community college program (56).

Perhaps the most significant difference between vocational technical schools and private training institutions is many private schools do not choose to voluntarily comply with industry's endorsed certification process through the National Automotive Technicians Education Foundation (NATEF). Private schools typically cost three to five times more than vocational technical schools and community colleges. Although typical two-year automotive service programs at private schools provide instruction to the NATEF minimum standard of 1,080 hours, they do not seek certification. Graduates enter into the same fields of employment as other training institutions' graduates (e.g., automobile dealerships) (56).

Advisory Committee. Each public and private training institution has an advisory committee which assists in overseeing the school's automotive training program. The function of an advisory committee is to advise and counsel the teachers and administrators in establishing and conducting the vocational occupations.

Citizens of the local community and the automotive industry are members of the advisory committee. The committee's responsibilities include:

- (1) Evaluate training to determine if the school is providing realistic training (e.g., review curriculum, facilities, and training aids).
- (2) Help secure training aids and provide assistance in the placement of graduates.
- (3) Provide inputs and support for legislation and corresponding funding at local, state, and federal levels.
- (4) Act as a communication link with the community.

(37)

Certification Agencies. The literature review indicates there are two organizations that certify automotive training schools. The first one is a non-profit organization called the National Automotive Technicians Education Foundation (NATEF), and the second organization is the individual states' department of education vocational training divisions.

National Automotive Technicians Education Foundation (NATEF). NATEF is a non-profit corporation founded by the automotive industry in 1983, which is ". . . dedicated to encouraging and improving automotive technological education throughout the nation" (64:30). NATEF and its sister agency, the National Institute for Automotive Service Excellence (ASE), are considered the most prestigious certifying bodies of automotive training

institutions and technicians in the U.S. automobile industry (63). According to Mr. Jim Wiblin, Assistant Director of Trade and Industrial Education for the State of Ohio, NATEF/ASE is the link between the automotive industry and technical training education (63). Essentially, NATEF evaluates the automotive education programs at community colleges and vocational technical schools to prepare mechanics for ASE-certification, while ASE administers written tests to certify individual mechanics (64:30).

Funding for NATEF comes through contributions from the industry. Compliance with NATEF standards is strictly voluntary throughout all training institutions (public and private). The industry looks to NATEF for assurances of receiving qualified entry-level technicians (64:30).

The following organizations either financially support, or officially endorse NATEF standards:

<u>Organization</u>	<u>Remarks</u>
General Motors	Cooperative training sites must be NATEF-evaluated and certified
Ford Motor Corp.	Endorses NATEF
Chrysler Motor Corp.	Endorses NATEF
Toyota Motor Corp.	Cooperative training sites must be NATEF-evaluated and certified
Nissan Motor Corp.	Encourage cooperative training sites to be NATEF-evaluated and certified
Honda Motor Corp.	Endorses NATEF

State Education Departments	Highly encourage schools to be NATEF-evaluated and certified
National Automobile Dealers Association	Endorses/financially supports NATEF
Automobile Service Association	Endorses/financially supports NATEF

To be certified by NATEF, schools must be evaluated in at least three of eight specialty areas:

- (1) Engine repair
- (2) Automotive transmission/transaxle
- (3) Manual drive train and axles
- (4) Suspension and steering
- (5) Brakes
- (6) Electrical systems
- (7) Heating and air conditioning
- (8) Engine performance (64:31)

Evaluation Process of NATEF. First, the school administration contacts NATEF headquarters at Herndon, Virginia, for a self-evaluation package. The five-part package contains task lists, program standards, policies and procedures, tools and equipment manual, and an evaluation guide.

The school then conducts a self-study of its training program by numerically scoring its program against the NATEF evaluation guide. The evaluation guide is divided into ten program standards:

- (1) Purpose

- (2) Administration
- (3) Learning resources
- (4) Finances
- (5) Student services
- (6) Instruction
- (7) Equipment
- (8) Facilities
- (9) Instructional staff
- (10) Cooperative agreements (42)

Within these ten standards, there are 154 questions on which the school instructors evaluate themselves on a scale of one to five (one = lowest, five = highest).

Additionally, within Standard 6, Instruction, the school must evaluate its course curriculum against NATEF's task list of high priority items. This task list describes in detail the curricula to be included in each of the eight specialty areas. To meet NATEF certification, a minimum of eighty percent of the high priority tasks must be included in the school's instructional program. The high priority tasks were established by an overwhelming consensus of automotive industrial committees and ASE-certified field technicians (44).

The third step involves sending the self-evaluation scores to NATEF headquarters. A NATEF automotive industry education expert reviews each line item on the evaluation guide. The expert looks for a minimum score of four on

each line item. If the school rated itself a three or less, a written justification must accompany the score. A low rating does not necessarily mean the program is deficient. The NATEF expert forms an overall impression of the school's readiness for a final on-site team review. Schools rated unsatisfactory are notified of their weaknesses and told to reapply once they have improved their deficiencies (53).

Schools successfully completing the self-evaluation are assigned an evaluation team which is scheduled for a two-day site visit. The evaluation team leader (ASE-certified automotive instructor) is assigned by the NATEF state director; three other team members (ASE-certified local area mechanics) are recommended by the school, with NATEF's approval. No team member can have a direct relationship with the school (65).

The final step is the actual team site visit, which takes place during normal school hours. The team re-runs the same NATEF evaluation guide to verify the results made by the school during the self-evaluation.

NATEF seeks to establish the framework of a training program (i.e., what to train) with which training institutions voluntarily comply. However, NATEF stops short of telling the training institution how to teach. NATEF seeks to establish a rapport with individual state departments of vocational education. NATEF has a state

director which administers NATEF evaluations for each state. In many cases, the state director is also an educator employed by the state department's vocational branch (65).

NATEF standards are the same in all fifty states, and allow room for individual state emphasis. For example, the emission control criteria according to NATEF standards are very general. However, the NATEF state director of California may require more details because of state emphasis on emissions control (65).

Automotive Service Excellence (ASE). As detailed in the above section, NATEF evaluates the training programs of community colleges and vocational schools. On the other hand, ASE tests and certifies mechanics through standardized written exams. An ASE-certified training institution instructs to minimum standards established by NATEF, all in an effort to prepare a student technician to pass an ASE certification test.

Like NATEF, ASE ". . . is a non-profit corporation dedicated to improving the quality of automotive service and repair throughout the nation" (42:2). A board of directors from all sectors of the automotive industry governs over ASE.

The ASE testing and certification program is administered by the American College for Testing (ACT), located at Iowa City, Iowa (42:2). The examinations are

designed to test diagnostic skills and repair situations, not theory (6:28). An ASE-certified technician offers an employer nationally accepted, proven skills and, in many situations, commands a higher wage over a technician who is not ASE-certified (30). A mechanic can become certified in four general categories:

- (1) Master automobile technician (8 tests)
- (2) Master heavy-duty truck technician (5 tests)
- (3) Body repair and painting/refinishing (2 tests)
- (4) Engine machinist (3 tests) (45:7)

Certification is valid for five years, after which time the technician must be retested to maintain currency.

#### State Education Department Certification.

The Vocational Education branches of each state's Department of Education ensure that minimum training standards are met at state-funded institutions. Each state adopts its own unique requirements based on state needs. The standards are written by educators, and a typical institution is validated for currency once every four to six years. However, there has been a recent movement among state and national educators in the automotive field to adopt minimum occupational training standards. The Carl D. Perkins Vocational and Applied Technology Education Act of 1990 has appropriated funds to enhance the development of national standards (63).

To this end, the state of Ohio and six other states have officially endorsed NATEF standards within their respective states. According to Mr. Wiblin, the NATEF standards are viewed by most state educators as the national standard. The national director of NATEF is currently pursuing adoption of NATEF standards at the federal level (65).

By using the state of Ohio as an example, sixty-three out of 100 state funded public schools are NATEF-certified (the highest of any state). According to Mr. Wiblin, the state of Ohio's goal is to have 100 percent participation of state-certified programs using NATEF standards by 1994. States' education departments view NATEF as the industry standard, because the standards are jointly developed and endorsed by the automobile industry and automobile educators (63).

The first half of the literature review examined military and civilian training issues. The following section of the literature review examines a comparative analysis technique known as benchmarking.

## Benchmarking

In its simplest form, benchmarking is a process of tracking down business practices and approaches judged to be among the best in the world, then copying and comparing the activities against one's own organization in an attempt to self-improve (2:12). The word "benchmark" gets its origin from land surveyors who used a benchmark as a reference point to compare elevations (61:203). Sun Tzu in his classic war manual, The Art of War, refers to the benchmarking concept by stating "If you know your enemy and know yourself, you need not fear the results of a hundred battles" (59:60).

Benchmarking, as applied today in modern U.S. commerce, was pioneered by the Xerox Corporation in the late 1970s, as a result of an effort to improve upon the quality of their copiers when market dominance began slipping away. Xerox executed perhaps the most documented benchmarking project when it investigated the L.L. Bean Company. Xerox visited the clothing mail order distributor and discovered an efficient warehousing and distribution system it could adapt to its copier business. Today, Xerox has incorporated benchmarking in every facet of doing business and is internationally renown for its application with over 350 studies completed (27:38).

Xerox is not the only corporation to employ benchmarking. Others like Motorola, Ford, GTE, and GM also

have adopted the comparison technique as an integral part of their quality improvement programs. Furthermore, the highly coveted Malcolm Baldrige National Quality Award requires benchmarking as a necessary element for receiving the honor (27:36).

Benchmarking, as a management tool, has been thoroughly researched and documented by Robert Camp, manager of benchmarking at Xerox, in his book, Benchmarking, The Search for Industry Best Practices that Lead to Superior Performance. Robert Camp is considered one of the most prominent experts in the field of benchmarking (2:12). Camp outlines the following 10-step process:

Planning

- (1) Identify what is to be benchmarked
- (2) Identify comparative companies
- (3) Determine data collection method and collect data

Analysis

- (4) Determine current performance "gap"
- (5) Project future performance levels

Integration

(6) Communicate benchmark findings and gain acceptance

- (7) Establish functional goals

Action

- (8) Develop action plans
- (9) Implement specific actions and monitor progress

(10) Recalibrate benchmarks (9:17)

In more detail, these ten steps (9:16-19) are described as follows:

Step one: Identifies the benchmark output and answers the question "what." Some output candidates include products manufactured, customer requirements, or processes used. Also, company performance measures can indicate what should be benchmarked.

Step two: Identifies comparative companies against which to benchmark. An organization can benchmark against internal operations, against external direct product competitors, against external functional industry leaders, or generic. To identify a superior performer, a firm should research trade journals, consultants, professional associations, vendors, or customers. This step answers the question "who."

Step three: Data collection is finding the information on best practices. The most common method is a direct site visit; however, telephone and mail surveys are possible. This step answers the question "how."

Step four: Up to this point, the output has been defined and data have been collected from the industry leader. Now the measurement of our product or service is compared with the measurements from the benchmarked company. The result is a positive or negative performance gap.

Step five: Here the firm measures the gap and sets new company performance goals to close the gap over a forecasted time frame.

Step six: This step deals with presenting the findings and recommendations to the organization.

Step seven: The firm writes specific objectives based on benchmarking findings to formulate or update goals.

Step eight: Here the firm identifies changes necessary to achieve benchmark findings and develops action plans.

Step nine: Once the findings have been developed and converted to accepted action plans, the final acts of implementation and monitoring are next. This step covers implementing and monitoring benchmarking action plans, and installing industry best practices.

Step ten: The final step requires reevaluation of the process to stay current with changing conditions and eventual institutionalizing of benchmarking.

There are five types of benchmarking: internal, competitive, functional, generic, and cooperative.

Internal benchmarking involves benchmarking against a company's own internal operations. This type of benchmarking is easily accomplished in large multidivision or international firms where there are similar functions in different operating units (9:61).

Competitive benchmarking is actually benchmarking against a direct product competitor. A major problem with this type of benchmarking is that it may be difficult to obtain information about the competitor's operations (9:63).

Cooperative benchmarking is actually a supplement to competitive benchmarking. It focuses on sharing process experiences, instead of purely functional results. Cooperative benchmarking often leads to widening vision and sharing overall objectives, as well as in-depth understanding (32:71).

Functional benchmarking involves benchmarking against functional competitors or industry leader firms, even if in dissimilar industries. This form of benchmarking can be highly productive. According to Robert Camp, "The key to success of these investigations is determining whether the industry leaders are driven by the same customer requirements" (9:64).

Generic benchmarking is benchmarking a process or function that is the same, regardless of dissimilarities of industries. The purest form of benchmarking, this method may uncover practices and methods not implemented in the investigator's own industry. This process requires objectivity and receptivity on the investigator's part (9:65).

Benchmarking in the Air Force. The largest documented application of benchmarking in the Air Force was by the Air Force Logistics Command (AFLC). In November 1990, benchmarking was officially approved by the AFLC Command Quality Council as a TQM method (7). The Command Quality Council established examples and guidelines in the form of a pamphlet, as a self-evaluation tool (1). Major processes within AFLC are:

(1) Benchmarked against the best in the field (either public or private sector);

(2) Measured to determine the baseline or starting point and appropriately documented; and

(3) Periodically measured for progress (i.e., process improvement), and annotated appropriately on a benchmark matrix. (7)

Paul Keller (AFLC/XPPV), Deputy of the Center for Quality Education at Wright-Patterson AFB, Ohio, teaches benchmarking techniques within AFLC. According to Mr. Keller, there are two known instances in which the Air Force has used benchmarking. First, AFIT has benchmarked classroom scheduling procedures by comparing similar operations at the University of Dayton, Wright State University, and Sinclair Community College (36). Also, Warner-Robins Air Logistics Center/SCQ has benchmarked its process action team analysis against Florida Power and Light, a recognized leader in the field (46).

Benchmarking in Civilian Training. The American Society for Training and Development (ASTD) is a non-profit

professional association working in the field of training and human resource development. The organization acts as a data bank for the latest issues and answers in the training arena through publication of printed materials and sponsored seminars. ASTD was contacted and revealed no information on automotive training benchmarking. ASTD required a membership fee of \$150 in order to access its data bank information file (3).

#### Chapter Summary

This review established the importance of training. The chapter focused specifically on vehicle maintenance training in the Air Force and in civilian industry, and provided a thorough discussion of benchmarking. There is no question that the literature emphasizes the necessity of training. A solid, updated training program is the key to success for any organization. It is the only means by which the Air Force and industry can keep up with changing technology, and in effect, remain competitive.

Renewed emphasis by the military services on training as the key to combat readiness highlights the need for government and industry to work together to eliminate training deficiencies and enhance training programs. (66:52)

The following chapter discusses the methodology used to answer the investigative questions of this research.

### III. Methodology

#### Introduction

This chapter will discuss in specific terms the research methods with which to answer the investigative questions. This chapter will be organized around each of the six investigative questions, with the appropriate methodology explained.

#### Research Objectives

Investigative Question One. The first question, "How does the Air Force conduct vehicle maintenance training?", was investigated by a site visit to Chanute AFB, Illinois. During the visit to the Automotive Technology Division at Chanute, informal interviews were conducted with the deputy chief of the division (24) and instructors. The researchers' objective was to gain a general overview of the program. Additionally, an unpublished document, "Issues and Alternatives for Vehicle Maintenance Training," by Colonel Swanson, provided a thorough summary of military and civilian automotive training (57). Air Force publication AFM 77-310, Volume II, "Vehicle Maintenance Management" (19); AFM 50-2, "Instructional Systems Design" (18); and AFR 50-23, "Enlisted Specialty Training" (17) were reviewed. Search of the AFIT DOD technical data base and queries to the Air Force Logistics Management Center

produced no prior or current study on training of Air Force vehicle mechanics.

Investigative Question Two. The question, "How does the civilian industry conduct automotive training," was answered through a combination of an extensive literature review, site visits, and informal interviews. The researchers' objective was to gain a general overview of the programs. Schools for site visits were selected based on proximity within the Dayton, Ohio, area. On the visits, the researchers conducted informal interviews with school administrators and staff instructors.

More background information on vocational education training was obtained from telephone interviews with the State of Ohio, Department of Education, Vocational Education Branch (47).

Finally, a visit was made to Columbus, Ohio, to interview an educational consultant for NATEF (53).

Investigative Question Three. The third investigative question, "What should be benchmarked in automotive training?" corresponds with Camp's first benchmarking step, "Identify what is to be benchmarked" (9:5).

The literature review indicated two areas of automotive training have already been studied: pre-enlistment recruitment training (PERT), and Interservice Training Review Organization (ITRO). In identifying what

to benchmark, the researchers focused on areas of automotive training that had not been previously studied. The researchers also reviewed both Chanute's higher headquarters checklists and self-inspection checklists. Additionally, the researchers attempted to focus on current issues raised by senior military transporters (57).

Investigative Question Four. The second step in benchmarking is to identify comparative organizations or benchmarking partners. The most difficult part of benchmarking is finding exemplary organizations. According to Robert Camp, "Finding the right company is an art, not a science" (9:3). The selection of the comparative company was based on findings in the literature review, and on recommendations from:

(1) External sources

a. Professional associations

- American Society for Training and Development (ASTD)
- Industrial Planning Council (IPC)
- National Independent Automobile Dealers Association (NIADA)
- Automotive Service Association (ASA)
- American Vocational Association (AVA)
- National Automobile Dealers Association (NADA)
- American Trucking Association/The Maintenance Council

- Motor Vehicle Manufacturers Association of the United States, Inc. (MVMA)
  - National Automotive Technicians Education Foundation, Inc. (NATEF)
- b. Experts in local universities and trade schools
- Cuyahoga Valley Joint Vocational School (CVJVS)
  - Montgomery County Joint Vocational School (MCJVS)
  - Sinclair Community College
  - Cincinnati GM Training Center
  - Ford Automotive Student Service Educational Training Program
  - Chrysler Apprenticeship Program

(2) Internal sources

a. Experts at the Automotive Technology Division, Chanute AFB, Illinois

b. Transportation training specialists at Air Training Command (ATC) Headquarters, Randolph AFB, Texas

The information revealed that potential benchmarking partners were in the following categories: community colleges, vocational technical schools, original vehicle manufacturers, and private institutions. In determining the benchmarking partner the researchers focused on community colleges and vocational technical schools.

Investigative Question Five. The fifth investigative question is, "What is the best method to execute the benchmark and gather the comparative data (Benchmarking step three)?" There are several methods of gathering data,

such as networking, piggybacking by electronic data exchange, library searches, professional and trade association data, consultants, and experts (9:76). The most credible and significant benchmarking method is the direct site-visit, where face-to-face exchange of data and information can be conducted (9:93). The researchers conducted a site visit to the benchmark training institution and gathered its best practices. Next, a second site visit was made to Chanute to gather data by applying industry's best practices.

Investigative Question Six. The final investigative question is, "What is the 'gap,' or measure of difference, between the Air Force and the leading civilian organization (Benchmarking step four)?"

There are three types of gaps: positive, negative, and a position where operations are at parity. A positive gap is where a company's internal operations exceed the benchmark. A negative gap is where a company's internal operations are below the benchmark. Parity is where the company's internal operations are equal to the benchmark. "What is desired in the gap's analysis is an objective assessment of their magnitude as well as an explanation of why the gap exists" (9:122).

The gap was determined by a comparative analysis of the leading civilian organization's best practice against Chanute's internal operations. According to Robert Camp,

the following items can be applied in conducting a comparative analysis:

- (1) Tabulating both descriptive and numeric data;
- (2) Determining the benchmark;
- (3) Determining the gap by comparison to internal operations data;
- (4) Evaluating and describing the reasons for the existence of the gap; and
- (5) Evaluating the factors that contribute to the best practice's existence. (9:122)

Any differences in practices were analyzed to determine if the practices can be implemented as a whole, or modified to benefit Chanute's environment.

#### Chapter Summary

This chapter addressed the specific methodology used to conduct the research study for each investigative question. The researchers adopted the first four steps of benchmarking from Robert Camp, a benchmarking expert (2:12). Furthermore, site visits to training organizations were identified as the most accurate method of data gathering.

## IV. Findings

### Introduction

This chapter will discuss the researchers' findings to each investigative question. The organization of the chapter centers around the research objectives.

### Research Objectives

Investigative Question One. The first investigative question is, "How does the Air Force conduct vehicle maintenance training?" A review of the literature and a site visit to Chanute AFB revealed that there are four basic AFSC-awarding courses. Based on the scope of this thesis, the research was confined to the apprentice general purpose (GP) vehicle mechanic AFSC, 47232.

The apprentice GP mechanic is trained to a partial proficiency level to perform repair activities on the GP fleet. The GP fleet includes sedans, station wagons, pickup trucks, buses, and tractor-trailer combinations (50:5). Partial proficiency level is defined according to the Specialty Training Skills (STS) as, "Can do most of the task. Needs help only on the hardest parts. . . . Can determine step by step procedures for doing the task" (50:10).

The basic courses for the GP mechanics are divided into five blocks over a period of fifty-seven days. The

fifty-seven days of instruction equate to 443 hours, of which 226.5 hours (fifty-one percent) are spent in the classroom, and 216.5 hours (forty-nine percent) are spent in the laboratory. This equates approximately to a 1:1 ratio of hours, which is consistent with Chanute's training philosophy of partial proficiency. It exposes the student to maximum coverage in the automotive field, with minimum depth. An extract of the Plan of Instruction (POI) for the five instruction blocks is in Appendix A.

<u>Instruction Block</u>	<u>Hours of Instruction</u>
(1) Vehicle Maintenance Associated Subjects	57.5
(2) Gasoline and Diesel Engines	106.0
(3) Electrical, Heating/Air Conditioning, and Hydraulics	96.0
(4) Power Train, Suspension, Steering, Brakes, Maintenance and Inspection	98.5
(5) General Purpose Engines/Chassis	<u>85.0</u>
	443.0
	(16)

To accomplish this training, Chanute currently has authorizations for thirteen military and six civilian GP instructors. In fiscal year 1991, 254 apprentice GP mechanics graduated from Chanute (24).

The school is scheduled to close in April 1993, and will relocate to Lackland AFB, TX, with other transportation training. Presently Chanute has doubled its student enrollment in anticipation of this closure (52).

Investigative Question Two. The second investigative question is, "How does the civilian industry conduct automotive training?" The literature indicated that most training for vehicle mechanics in the civilian sector is conducted either by original vehicle manufacturers, or by public and private training institutions.

Site visits were made to four training institutions in Ohio: Cuyahoga Valley Joint Vocational School (CVJVS), Brecksville (37); Montgomery County Joint Vocational School (MCJVS), Clayton (4); Sinclair Community College, Dayton (30); and the General Motors Training Center, Cincinnati (49). The civilian institutions which most closely parallel the military training program are vocational technical schools and community colleges, because they train to entry-level positions and are publicly funded. The vocational technical schools and community colleges must meet individual state training certification. Although many private training programs train to entry-level positions, they are not required to adhere to a state education department certification or accreditation. The researchers focused on vocational technical schools because they are non-degree awarding programs.

The site visits to CVJVS and MCJVS revealed that both provide vocational training for high school students and adult students living in their respective school districts. There is a close relationship between the local community

automotive industry (e.g., automobile dealers) with the programs. As a result of this relationship, schools receive donations of equipment and money throughout the year. Also, both schools' programs are NATEF-certified (4,30).

High school students graduating from these programs are considered entry-level technicians. The graduates are exposed to more hands-on training versus theory training, and in turn, may require more training and/or guidance in the field. At CVJVS, students receive 982 actual hours of instruction, and at MCJVS, students receive 1,224 actual hours of instruction (4,30).

According to Mr. Gary Bambauer, Automotive Instructor Supervisor at MCJVS, one difference between CVJVS and MCJVS is that at CVJVS, adult students may progress through the curriculum on a space-available basis with the high school students during the school day. At MCJVS, night classes are offered for adults seeking retraining in a certified automotive specialty area. The adult students at MCJVS attend separate courses from the high school students. Also, MCJVS offers on-campus and on-site industrial training for employees of local automotive service organizations (4).

The site visit to Sinclair Community College provided insight on a typical community college automotive training program. For example, at Sinclair, the associate degree is

completed over six quarters, averaging seventeen hours per quarter:

	Credit <u>Hours</u>
Core Automotive Courses	63
General Education	<u>39</u>
Total Quarter Credit Hours	102

The non-degree certification program requires up to ten classes (part-time or full-time), with sixty credit hours in core automotive courses. This program emphasizes student preparation for Automotive Service Excellence (ASE) certification (55:75).

Sinclair offers automotive training in four different areas. The first area, the Automotive Technology Degree program, includes up-to-date technical training on all automotive systems, leading to an associate degree. The second area, Cooperative Programs, is an automotive technology degree program which teaches on specific make vehicles (e.g., GM's Automotive Service Educational Program), allowing students to alternate training time between Sinclair and an automotive dealership. The third area, Automotive Technology Certificate, has the same automotive content as the degree program, but requires only one math course. Finally, the fourth program area at Sinclair includes the short-term, aftermarket, non-credit program, which provides for seminars during the evening, on current automotive technology (30).

The difference between a vocational technical school and a community college is that a community college emphasizes more written and oral communication skills, and management skills. Community college graduates have better opportunities for advancement into management positions (e.g., service department manager). Additionally, the associate degree can be applied towards a four-year bachelor of science degree in automotive technology (30).

The researchers also conducted a site-visit at the GM Training Center in Cincinnati, Ohio. According to Mr. James Russell, assistant manager of the training center at Cincinnati, GM has twenty-seven training centers that provide short courses for GM automotive technicians to keep them updated with the latest technology. GM offers over 100 courses, lasting in duration from one to eight days, in fourteen general areas, ranging from heating/air conditioning to accessories. Local dealers are eligible to send technicians to these courses held at one of the twenty-seven training centers, or at 163 other satellite locations, like community colleges. A typical class at a GM training center has twelve students. Ten seats are reserved for GM dealers, and two seats are reserved for organizations with large fleets of GM vehicles (e.g., U.S. Air Force, Federal Bureau of Investigation, U.S. Postal Service). Videotape training is also offered by GM to the dealerships (49).

In contacting the Ohio Department of Education, the researchers learned that the state of Ohio has adopted NATEF standards for automotive training certification. The Ohio Department of Education has established a goal that by 1994, all publicly funded training institutions [community colleges, vocational technical schools] should be NATEF-certified. Currently, sixty-two percent of Ohio's training institutions are NATEF-certified (63).

From the informal interview with NATEF's educational consultant, Dr. Shoemaker, the researchers learned that the education departments of nine states have adopted NATEF-certification for their schools: Arkansas, Florida, Georgia, Indiana, Kentucky, North Dakota, Ohio, Oklahoma, and Utah. Furthermore, of the estimated 2,500 automotive training institutions in the U.S., approximately 580 are NATEF-certified (53).

Table 1 contains a summary of the hours of instruction (laboratory and lecture) for each of the schools visited, compared to the minimum hours required by NATEF standards.

TABLE 1  
COMPARISON OF COMMON CURRICULA  
AMONG VEHICLE MECHANIC TRAINING PROGRAMS  
(in units of actual classroom and lab hours)

<u>SPECIALTY AREA</u>	<u>CHANUTE</u> <sup>1</sup>	<u>SINCLAIR</u> <sup>2</sup>	<u>CVJVS</u> <sup>3</sup>	<u>NATEF</u> <sup>4</sup>
Transmission/Transaxle	31	110	115	100
Brakes	46.5	80	95	80
Electrical Systems	55	200	220	200
Engine Performance	58.5	240	240	240
Engine Repair	44	150	130	120
Heating/Air Conditioner	18	100	50	100
Manual Drive/Axles	36	140	90	140
Steering and Suspensions	41	100	140	100
Subtotal	330	1120	1080	1080
Diesel Engine Repair	113	0	0	0
Total Hours - Classroom and Laboratory	443	1120	1080	1080

<sup>1</sup> Includes only the 57 days of General-Purpose Vehicle Training.

<sup>2</sup> Includes only the automotive technology courses for automotive associate degree program.

<sup>3</sup> Includes only automotive courses taught for high school and adult students. Automotive program is NATEF-certified in six of eight specialty areas.

<sup>4</sup> Indicates minimum instructional hours for conventional, gasoline engine programs.

(16, 23, 38, 43)

Investigative Question Three. The third investigative question is, "What areas should be benchmarked in

automotive training" (Benchmarking step one)? The literature indicated that a generic training program should be divided into four general areas for purposes of analysis: facilities, instructors, curriculum, and training aids (34,15,31). Chanut's ATC checklist items were grouped into four general program standards which served as a guide to evaluate automotive training programs. The ATC categories are facilities, curricula, student operations, and instructors.

Also, two special interest items from Colonel Swanson's report were of interest to the researchers: Utilization and Training Workshop (U&TW) and acquisition of training aids (57:20). The Utilization and Training Workshop (U&TW) is a collection of senior automotive transportation personnel who decide what should be included in the training curriculum at Chanut. The U&TW can be likened to an advisory committee. The acquisition of training aids includes the purchase of new or up-to-date vehicles with the latest technology to be used as training aids.

Furthermore, the researchers discovered that the NATEF self-evaluation process specifically addresses the topics identified by training literature, ATC checklists, and Col. Swanson, as well as other training topics. The ten NATEF program standards (43) for self-evaluation are:

- (1) Purpose

- (2) Administration (Swanson)
- (3) Learning resources
- (4) Finances
- (5) Student services (ATC, training literature)
- (6) Instruction (ATC, training literature)
- (7) Equipment (Swanson, training literature)
- (8) Facilities (ATC, training literature)
- (9) Instructional staff (ATC)
- (10) Cooperative agreements

The researchers concluded that the ten NATEF self-evaluation areas satisfactorily answer what should be benchmarked at Chanute.

Investigative Question Four. The fourth investigative question is, "Who are leading comparative civilian automotive training organizations" (Benchmarking step two)?

Of the pool of automotive training organizations available to the researchers (i.e., community colleges, vocational technical schools, and private schools), the researchers selected Cuyahoga Valley Joint Vocational School (CVJVS) as the benchmark training program.

Cuyahoga, like Chanute, is publicly-funded, non-degree awarding, and trains to an entry-level, or apprentice skill-level. Other reasons for their selection include:

- (1) They were the 1990 winner of the Motor Vehicle Manufacturers Association (MVMA)/American Vocational Association (AVA) Award for Excellence, for the secondary education program level.

(2) The State of Ohio Board of Education recommended their program (63).

(3) They are NATEF-certified in six of the eight maintenance specialty areas.

(4) The school was located near the researchers.

CVJVS's program consists of eight, nine-week blocks over two years. Students meet for three hours a day, or a total of 135 hours of instruction per block. Eighty percent of the students' time is spent in the laboratory, and twenty percent of their time is spent studying theoretical principles in the classroom. CVJVS allows adults to take blocks of instruction with the high school students on a space-available basis (37).

CVJVS represented the best available match for a comparison to the U.S. Air Force automotive training program. The researchers recognize there are some differences between civilian and military training philosophies. However, the purpose of this thesis is to see if there are some practices in the civilian industry that can be adopted by the U.S. Air Force (i.e., close the information gap).

Investigative Question Five. In answering the fifth investigative question, "What is the best method to execute the benchmark and gather the comparative data" (Benchmarking step three), the researchers conducted a site-visit to the benchmark organization, CVJVS. As a result of identifying CVJVS as the best comparative

benchmarking partner, its best practice was adopted. According to Mr. Frank Manley, senior automotive training instructor at CVJVS, the most important ingredient of their training program was becoming NATEF-certified (37).

Furthermore, CVJVS's best practice, NATEF certification, was supported in the literature review as the industry's best practice. For example, all major vehicle manufacturers, most automotive educators, and automotive trade associations endorse and/or support industry-wide compliance to NATEF training standards. Therefore, the principal evaluation tool to compare the Automotive Technology Division at Chanute against the best civilian program, CVJVS, is through the NATEF certification process. This type of benchmarking, where the focus is on the leader's best process or practice, is referred to as cooperative benchmarking (32:71).

Next, in the data-gathering process, the researchers contacted NATEF headquarters in Herndon, Virginia, and obtained information on conducting a self-study. The steps in conducting a self-study are:

- (1) Purchase self-evaluation materials;
- (2) Conduct a self-study using the advisory committee, staff, or combination of the two;
- (3) Submit the self-evaluation for review by NATEF; and
- (4) Arrange for and coordinate the outside team review of the areas approved for review by NATEF. (65)

The researchers executed steps one through three of the certification process. The first step was accomplished when NATEF sent the researchers a packet of information which included the following documents: policies and procedures, task list, evaluation guide, tools and equipment manual, and program standards. An extract of NATEF's self-evaluation material is included in Appendix B.

The second step was accomplished when the researchers conducted a second site visit to Chanute to apply the NATEF self-study (52). First, the researchers contacted the Automotive Technology Division chief, who assigned the deputy division chief to aid the researchers in running the self-evaluation checklists. The deputy chief assigned the following experts to rate Chanute's status on each checklist item on a scale of one to five:

- (1) Supervisor, GP instructors [Self-evaluation coordinator]
- (2) Five instructors from the five GP blocks
- (3) Two supply/tool crib custodians

The researchers and experts jointly accomplished the first run of the checklist by assigning a single, numerical subjective rating for each of the 154 self-study checklist items. The rating scale used to evaluate the items ranged from one (poor) to five (excellent). Where appropriate, documentation was produced from files, and hands-on verification of equipment was conducted to support assigned ratings.

In determining percentages of high priority tasks from Standard 6, Instruction, the researchers interviewed instructors from blocks one through five. Through lesson plans and teaching experience, the instructors identified tasks listed in NATEF's Task List pamphlet (44). These items were then averaged to determine the percentages of high priority tasks met per specialty area. Also, the researchers reviewed Chanute's Plan of Instruction (POI) for Apprentice GP Mechanics, which detailed course content, student instructional material, training method, instructional guide, and time allotment (16).

The researchers and division chief accomplished a second run of the checklist as a second opinion. The final scores submitted to NATEF were an average of the two runs of the checklists. For checklists items rated poorly, a narrative justification was attached. Because of NATEF's civilian industry orientation, the researchers encountered many items that were not applicable to Chanute's training process. For example, NATEF checklist Standard 1, Purpose, was addressed primarily towards employment potential and commercial advertising of the program. With the exception of item 1.1.B., all of Standard 1 was not applicable to Chanute's training program. Out of a total of 154 checklist items, forty-three items were rated not-applicable.

The following examples illustrate the procedures the researchers and experts used in order to assign ratings while running the NATEF checklist at Chanute. Checklist Standard 9.1 addresses technical competency of instructors. The evaluators inspected individual instructor files to determine number of years of work experience, number of years as an instructor, whether or not they were ASE-certified, and the number of years of education beyond high school. A second example, was in assessing checklist Standard 7.4, which asks, "Is a preventative maintenance program used to minimize equipment down-time?" To answer this, the researchers looked for evidence (e.g., paper documentation). The preventative maintenance program was found to be excellent because all training aids visually appeared to be in outstanding condition, and there was thorough evidence of a contractor schedule to perform routine preventative maintenance. The experts assigned this item a rating of four; the division chief assigned a rating of five. Therefore, the score reported to NATEF was 4.5, an average of the assigned ratings.

The researchers relied on the experience and careful observations of Chanute's experts/division chief when they assigned ratings.

In the third step, the final package submitted to NATEF included the evaluation guide rating sheet, a narrative justification for low scores, a listing of

Chanute's instructional hours, and a background paper on the Automotive Technology Division (50). An extract of the researchers' final submission to NATEF is provided in Appendix C.

Investigative Question Six. The sixth investigative question is, "What is the 'gap,' or measure of difference, between the Air Force and the leading civilian organization?" (Benchmarking step four). The gaps between Chanute's training program and the leading organization's best practice were determined by NATEF's review and return of the researchers' self-evaluation package. NATEF's formal report to the researchers is shown in Appendix D. To analyze the gap, the researchers followed Robert Camp's comparative analysis items (9:122).

Three gaps were identified, and were used as the basis to present the data. The gaps were tabulated in instructional hours, curriculum content, and program standard scores. The benchmark was determined in Investigative Question Four as CVJVS. The researchers adopted CVJVS's best practice, the NATEF certification process, and applied it to Chanute's training program. The gaps were determined by subtracting Chanute's data from NATEF's data.

Gap One: Instructional Hours. The following table shows a tabulation of the benchmark's data and

Chanute's data. The numbers for Chanute represent the actual hours spent in laboratory and lecture over fifty-seven training days.

TABLE 2  
GAP 1: INSTRUCTIONAL HOURS

<u>SPECIALTY AREA</u>	<u>NATEF</u>	<u>CHANUTE</u>	<u>GAP</u>
Automatic Transmis- sion/Transaxle	100	31	Negative (69)
Brakes	80	46.5	Negative (33.5)
Electrical Systems	200	55	Negative (145)
Engine Performance	240	58.5	Negative (181.5)
Engine Repair	120	44	Negative (76)
Heating/Air Conditioning	100	18	Negative (82)
Manual Drive Train and Axles	140	36	Negative (104)
Suspension and Steering	100	41	Negative (59)
TOTAL	1080	330	Negative (750)

Chanute's POI includes 443 total hours. NATEF did not permit 113 hours for diesel engine performance and repair to be counted. The NATEF technician certification training program does not include diesel engine training. This training is covered under a separate NATEF heavy truck certification program. Consequently, only 330 hours applied.

(43,16)

This gap exists because the apprentice GP program is only fifty-seven days in length, which equates to a maximum availability of 443 hours. For the GP program to be NATEF-

certified, its course length would have to be a minimum of 135 days [NATEF's minimum hours, 1,080, divided by eight training hours per day].

NATEF's minimum requirement of 1,080 instructional hours was established by the automotive industry as a standard for its entry-level automotive technicians (53). Typical graduates from a NATEF-certified institution enter a dealership service department, or other automotive repair activities, as entry-level technicians, with their own basic set of hand tools. The graduates are expected to perform most service and repair tasks independently, with minimal guidance or supervision. Graduates usually require additional training, or more extensive assistance on only late-model automobile technology (23).

Gap Two: Curriculum Content. The following table shows a tabulation of the benchmark's data and Chanute's data. The numbers for Chanute represent the percentages of NATEF's recommended curriculum content included in Chanute's plan of instruction. To achieve the benchmark, a training program must include at least eighty percent of NATEF's high priority curriculum tasks in its plan of instruction (44).

TABLE 3  
GAP 2: CURRICULUM CONTENT

<u>SPECIALTY AREA</u>	<u>NATEF</u>	<u>CHANUTE</u>	<u>GAP</u>
Automatic Transmis- sion/Transaxle	80%	25%	Negative (55%)
Brakes	80%	50%	Negative (30%)
Electrical Systems	80%	57%	Negative (23%)
Engine Performance	80%	57%	Negative (23%)
Engine Repair	80%	33%	Negative (47%)
Heating/Air Conditioning	80%	54%	Negative (26%)
Manual Drive Train and Axles	80%	17%	Negative (63%)
Suspension and Steering	80%	34%	Negative (46%)
			(44,16)

This gap exists because Chanute's fifty-seven days of training is not sufficient time to cover all the high priority items on NATEF's task list. As mentioned under the first gap, a training program of 135 days would be more likely to meet NATEF's minimum standards for high priority tasks.

The automotive experts determined that the eighty percent minimum requirement for high priority curriculum tasks represents a ". . . well-developed task list that serves as a basis for course of study outlines" (44:1). Furthermore, the industry believes the eighty percent

standard indicates to employers across the country that a graduate is skilled in a minimum of three of eight specialty areas (44:1).

Gap Three: Program Standards. The following data represents Chanute's average scores for each of NATEF's program standards.

TABLE 4  
GAP 3: PROGRAM STANDARDS

<u>STANDARD</u>	<u>NATEF</u>	<u>CHANUTE</u>	<u>GAP</u>
1 (Purpose)	No minimum <sup>1</sup>	1.0	Meets standard
2 (Administration)	No minimum <sup>1</sup>	4.09	Meets standard
3 (Learning Resources)	No minimum <sup>1</sup>	4.55	Meets standard
4 (Finances)	No minimum <sup>1</sup>	4.30	Meets standard
5 (Student Services)	No minimum <sup>1</sup>	4.33	Meets standard
6 (Instruction)	4.0 <sup>2</sup>	4.05	Meets standard
7 (Equipment)	4.0 <sup>2</sup>	4.17	Meets standard
8 (Facilities)	4.0 <sup>2</sup>	4.10	Meets standard
9 (Instructional Staff)	4.0 <sup>2</sup>	3.83	Negative
10 (Cooperative Agreements)	No minimum <sup>1</sup>	N/A	N/A

<sup>1</sup> There is no minimum score established for Standards 1, 2, 3, 4, 5, and 10. A low rating on a standard does not necessarily mean the program is deficient (42:2).

<sup>2</sup> The average rating on Standards 6, 7, 8, and 9 "shall be no less than four on a five-point scale" (42:1).

Within Program Standard 9, Subsection 9.3.B., Technical Update, was rated three out of five. Both the researchers and the experts/division chief at Chanute did not find evidence of instructors being given the opportunity to return to the industry on a regular basis for in-service and skill upgrading. The rating on this subsection pulled the average score for Standard 9 below NATEF's minimum of four.

The minimum standard of four for this subsection reflects industry's desire that automotive instructors must be afforded the opportunity (e.g., annually) to return to vehicle and equipment manufacturer-sponsored training and/or automotive education-sponsored upgrading.

Additionally, within Program Standard 9, the researchers evaluated the technical competency of seventeen GP instructors at Chanute. This data is shown in Table 5.

NATEF requires automotive instructors to hold a current ASE certification in the areas the school is seeking certification, or the instructors must have a total of six years experience with at least three of the six years as a practicing general automobile technician. The remaining years can come from additional technical experience, or post-high school training (43:8).

TABLE 5  
CHANUTE GENERAL PURPOSE INSTRUCTOR BACKGROUND

<u>INSTRUCTOR (RANK)<sup>1</sup></u>	<u>YEARS AS A PRACTICING AUTOMOBILE TECHNICIAN</u>	<u>YEARS OF COLLEGE</u>
1 (GS-11)	6	6
2 (GS-11)	7	2
3 (GS-9)	31	2
4 (GS-9)	38	2
5 (GS-9)	28	2
6 (GS-9)	11	2
7 (E-7)	19	2
8 (E-7)	4	3
9 (E-6)	13	2
10 (E-5)	19	0
11 (E-5)	16	2
12 (E-5)	12	0
13 (E-5)	9	0
14 (E-5)	12	4
15 (E-5)	11	2
16 (E-5)	8	6
17 (E-3)	6	2

<sup>1</sup> Of the seventeen instructors for GP automotive training, three military personnel and one civilian are ASE-certified.

(8)

The data indicate that with the exception of one [instructor 8], the GP instructors at Chanute exceed the NATEF standard of six years as a practicing automobile technician, creating an overall positive gap in this area.

The following is a summary of NATEF's assessment of Chanute:

(1) The GP apprenticeship program is less than NATEF's minimum requirement of 1,080 instructional hours.

(2) Chanute's training program does not meet a minimum of eighty percent of NATEF's high priority items.

(3) Standard 9, Instructional Staff, rated less than the minimum requirement of 4.0.

(4) The program is not ready for a follow-on outside team review. (54)

#### Further Findings

In the course of conducting the NATEF certification process at Chanute, three other areas emerged, which were of interest to the researchers: vehicle training aids, an advisory committee, and advanced training technology.

Vehicle Training Aids. The use of vehicles as a training aid is essential in the learning process. Vehicles, as opposed to other training aids (e.g., commercially-designed trainers, engine stands, and test equipment), represent the most realistic environment for training. There was not a specific NATEF checklist line-item addressing training aids, so the researchers compared Chanute's training aids with the benchmark organization, CVJVS. The data are presented in the following tables.

TABLE 6

## GENERAL PURPOSE VEHICLE TRAINING AIDS AT CHANUTE

<u>MAKE</u>	<u>MODEL</u>	<u>YEAR</u>	<u>QUANTITY</u>
Sedan <sup>2</sup>	Plymouth	1988	1 each
3-Passenger Truck <sup>2</sup>	Chevrolet	1987	1 each
Truck <sup>1</sup>	GMC	1986	1 each
Compact Truck <sup>1</sup>	Dodge	1986	4 each
Sedan <sup>1</sup>	Plymouth	1986	1 each
4x4 Pickup Truck <sup>1</sup>	Dodge	1985	2 each
Sedan <sup>1</sup>	Ford	1985	1 each
Sedan <sup>1</sup>	Plymouth	1985	1 each
4x4 Utility Truck <sup>2</sup>	Dodge	1985	2 each
Station Wagon <sup>2</sup>	Plymouth	1985	1 each
Compact Truck <sup>2</sup>	Ford	1985	1 each
Sedan <sup>1</sup>	Chevrolet	1984	3 each
Sedan <sup>2</sup>	Plymouth	1983	1 each
Station Wagon <sup>2</sup>	Plymouth	1983	1 each
4x4 Utility Truck <sup>2</sup>	Chevrolet	1983	1 each
Compact Truck <sup>1</sup>	Dodge	1982	2 each
3-Passenger Truck <sup>1</sup>	Dodge	1981	4 each
Stake Truck <sup>1</sup>	Dodge	1981	1 each
Station Wagon <sup>1</sup>	Ford	1978	2 each
Sedan <sup>1</sup>	AMC	1978	4 each
Truck <sup>1</sup>	GMC	1976	1 each
1.5 Ton Truck <sup>2</sup>	Chevrolet	1966	1 each
			<u>37 total</u>

<sup>1</sup> GP vehicles with registration numbers in the Air Force inventory, under management codes B102 - B361.

<sup>2</sup> Previously salvaged Air Force vehicles which were reconditioned for use as local GP vehicle trainers.

(21)

TABLE 7  
VEHICLE TRAINING AIDS AT CVJVS

<u>MAKE</u>	<u>MODEL</u>	<u>YEAR</u>	<u>QUANTITY</u>
Sedan	GM	1991	1 each
Van	Chrysler	1991	1 each
Sedan	Chrysler	1988	1 each
Sedan	GM	1988	2 each
Sedan	Ford	1988	1 each
Sedan	GM	1987	3 each
Sedan	GM	1986	1 each
Sedan	Nissan	1985	1 each
Sedan	GM	1984	1 each
Sedan	Ford	1984	1 each
Station Wagon	Ford	1983	1 each
Sedan	Ford	1982	1 each
Sedan	Chevrolet	1976	1 each
Sedan	Chevrolet	1972	1 each
			17 total
			(37)

The researchers discovered there are two types of vehicle trainers at Chanute. The first type includes vehicles, with registration numbers, that are part of the Air Force inventory. The second type of vehicle trainers are former inventoriable Air Force vehicles that were damaged beyond economical repair from operational air bases, and were donated to Chanute. Chanute instructors restored the damaged vehicles to be used as viable training aids (52).

Chanute, like any other Air Force base, relies on the Air Force vehicle buy program for its acquisition of vehicle trainers. The two replacement criteria of the vehicle buy program include vehicle age and mileage (8).

Specifically at Chanute, the vehicle buy program does not appear to be the best method to acquire new vehicles with the latest technology, because Chanute's vehicle trainers do not acquire any noticeable mileage. Consequently, the inventorable assets range from 1976 to 1986. Furthermore, Chanute has to rely on an informal mechanism (i.e., donated, salvaged vehicles that must be reconditioned for use) to stay abreast of changing automotive technology.

In comparison, CVJVS receives donated vehicles through its advisory committee, board of education, and local citizens. Through the advisory committee's meetings with the school administration, the school's training aid requirements are met. CVJVS's advisory committee has representatives from the automotive industry, to include equipment manufacturers and local automobile dealers. Also, CVJVS relies on "live work" to expose the students to a wider variety of street legal vehicles. Street legal vehicles are owned by private citizens and are serviced by the students as part of their training program under the supervision of the instructors. Vehicle owners are charged only for the replacement parts. CVJVS receives an average of one street legal vehicle per day. These vehicles are owned by local citizenry (37).

Advisory Committee. Equally important to the training process is the advisory committee, which oversees all phases of the training program. Advisory committee

meetings oversee civilian automotive training programs, and by comparison, the U&TW oversees the Air Force's automotive training program. When the researchers ran the NATEF checklist, the following program standards (with respect to the U&TW) were graded poorly by Chanute's experts/division chief:

- (1) Standard 1.1.B., Are employers surveyed on a regular basis (at least annually) to determine training needs? ["Employers" is interpreted as members of the U&TW.] (rating = 1)
- (2) Standard 2.5.A., Does the Advisory Committee meet two or more times a year? (rating = 1)
- (3) Standard 8.11, Does the Advisory Committee conduct an annual evaluation of the facilities? (rating = 1)

As indicated in the literature review of this study, the U&TW has met twice within the past eight years. In comparison, CVJVS's advisory committee, as a minimum, meets quarterly (37).

Technologically Advanced Training Media. The researchers discovered Chanute is applying two types of technologically advanced training media: computer-based instruction (CBI) and distance-learning, via satellite.

Chanute employs two full-time vehicle maintenance computer programmers who convert traditionally instructor-led courses into CBI. The school uses thirty personal computers for delivering a portion of the instructional materials, as well as administering progress checks and block examinations. The CBI programs were written in Ten-

CORE computer programming language. The advantages of using CBI are standardization of curricula, and allowing instructors more classroom preparation time (52).

Distance-learning via satellite is also being used at Chanute in an effort to save TDY funding and allow greater exposure of advanced courses to the field. At the time of this research, Chanute was in the process of conducting two trial broadcasts of the Advanced Automotive Electrical Systems Course from Fort Lee, Virginia, to twenty Air Force bases (52).

The extent to which Chanute applied technologically advanced training media was not observed at CVJVS or other civilian training organizations visited by the researchers. At CVJVS, the only computer-based training application was on one personal computer, which had the Mitchell Manual software application for researching automotive parts (37).

#### Chapter Summary

This chapter presented the researchers' findings for each of the six investigative questions. Investigative Questions One and Two addressed how the Air Force and civilian industry conduct vehicle maintenance training. Investigative Questions Three and Four determined comparative training program areas and identified the civilian industry leader. Finally, Investigative Questions Five and Six applied the industry leader's best practice,

NATEF-certification, and identified negative gaps in Chanute's training program.

The following chapter presents the researchers' conclusions and recommendations for further study.

## V. Conclusions and Recommendations

### Introduction

This study addressed six major investigative questions in the process of benchmarking vehicle maintenance training between the U.S. Air Force and a comparative civilian industry leader. The conclusions drawn on the investigative questions will be presented first, followed by recommendations for potential future research.

### Conclusions

Investigative Questions One and Two. The first two investigative questions asked, "How do the Air Force and civilian industry conduct vehicle maintenance training?"

The Air Force trains its apprentice GP vehicle mechanics in fifty-seven days. In comparison to civilian industry, this short time period allows for only a basic introduction to the various automotive systems. Equal time is spent in the classroom, as well as the laboratory. Furthermore, Chanute devotes approximately one-fifth of the training time to diesel engines, which are not addressed in the civilian automotive training programs. Consequently, the short training period places heavy reliance on on-the-job training at the base-level to develop fully-qualified automotive technicians. This approach to training is

consistent with the Air Force philosophy of a partial proficiency level of training.

Even though the training time at Chanute seems very short, the graduates from Chanute earn twenty-one college credits through the CCAF. This credit is approximately one-third of the requirement to earn CCAF's Associate in Applied Science Degree in Logistics and Resources.

The civilian automotive industry includes entry-level and advanced training through original vehicle manufacturers, public and private institutions, and certifying bodies.

The typical entry-level program is twenty-four months in length. Associate degree awarding programs emphasize more theory and management training, compared to non-degree programs, which are more "hands-on" oriented. The two-year program gives graduates sufficient depth of training to enter the job market at an entry-level position, fully qualified to work on all automotive systems with minimal supervision. Furthermore, the graduates are required to have in their possession their own set of basic hand tools.

A growing percentage of civilian institutions are recognizing the need to adopt the industry-established, national training standard, which is the NATEF certification process. Training institutions voluntarily comply with NATEF to ensure their graduates receive an industry-certified education. Moreover, nine states'

education departments have adopted NATEF certification for their schools. Currently, twenty percent of the training industry is NATEF-certified.

Investigative Question Three. To address the third investigative question, "What areas should be benchmarked in automotive training," the researchers focused on areas of automotive training that had not been previously studied. The literature review identified six areas of interest within a solid training program: administration, student services, instruction, equipment, facilities, and instructional staff. Moreover, these six potential benchmark areas, plus others, are included in NATEF's program standards for the certification process. The ten program standards, which were discussed in detail in Chapter II, are presented again below:

- (1) Purpose
- (2) Administration
- (3) Learning resources
- (4) Finances
- (5) Student services
- (6) Instruction
- (7) Equipment
- (8) Facilities
- (9) Instructional staff
- (10) Cooperative agreements

The researchers concluded that the NATEF certification process identified the areas that were to be benchmarked at Chanute.

Investigative Question Four. In answering the fourth investigative question, "Who are leading comparative civilian automotive training organizations," the researchers did not find any one civilian institution that came close to the training philosophy of the Air Force. Therefore, the researchers searched for a benchmarking partner which was publicly funded, non-degree awarding, and trained to an entry-level. Consequently, the researchers selected a vocational technical school as the leading comparative civilian automotive training organization. The benchmark organization was CVJVS. As mentioned in the Literature Review, there were other reasons for which CVJVS was selected. They are listed again below.

(1) They were the 1990 winner of the MVMA/AVA Award for Excellence, for the secondary education program level.

(2) The State of Ohio Board of Education recommended their program.

(3) They are NATEF-certified in six of the eight possible maintenance specialty areas.

(4) The school was located near the researchers.

Investigative Question Five. The fifth investigative question, "What is the best method to execute the benchmark and gather the comparative data," was accomplished through a site-visit to CVJVS, where the researchers identified and

adopted their best practice, NATEF-certification. The researchers incorporated the NATEF-certification process as the means of gathering the data to compare Chanute with the benchmark organization. To conduct the data gathering process, the researchers obtained NATEF's self-study materials; made a site-visit to Chanute, where they conducted the self-study using Chanute's staff; and they submitted the self-study evaluation package to NATEF for review.

Investigative Question Six. The sixth investigative question is, "What is the 'gap,' or measure of difference, between the Air Force and the leading civilian organization?" The researchers discovered four gaps in the following areas: instructor hours, high priority tasks, program standards, and advisory committee.

Gap One, Instructional Hours, was negative in all eight specialty areas because Chanute's 330 instructional hours did not meet NATEF's minimum requirement of 1,080. This negative gap was anticipated because Chanute's apprentice GP vehicle mechanic program is only fifty-seven days in length. To meet the NATEF standard, Chanute's program would have to include at least 135 days of instruction.

In Gap Two, Curriculum Content, Chanute had a negative gap in all eight specialty areas. Similar to Gap One, this

finding was also anticipated because of Chanute's short fifty-seven day training program.

In Gap Three, Program Standards, of the ten NATEF program standards, only one standard had a negative gap at Chanute. The instructional staff at Chanute was below NATEF's minimum because they lacked technical updating. NATEF's minimum requirement for this standard is for instructors to return to original vehicle manufacturers' workshops, or automotive education sponsored upgrade training.

Also, within Program Standard 9 of the NATEF self-study conducted at Chanute, all seventeen GP instructors were evaluated for technical competency. Only one of the seventeen instructors fell below NATEF's minimum requirement of six years of automotive experience. The experience of the GP instructors ranged from four to thirty-eight years, as indicated in Table 5 of Chapter IV. Four of the instructors were ASE-certified. However, NATEF requires all instructors to be ASE-certified when an institution is seeking recertification.

Because of the above gaps, the Air Force institution is not ready for a follow-on site-visit and program certification by NATEF.

Further Findings. As a result of performing the NATEF certification process, the researchers discovered three additional findings.

First, Chanute's mechanism to acquire vehicle training aids, the Air Force vehicle buy program, does not appear to supply Chanute with late-model vehicles. Instead, they must rely on an informal process of reconditioning salvaged vehicles, to have late-model vehicles for instructional purposes.

Secondly, the infrequent meetings of Chanute's advisory committee, U&TW, do not allow the committee to perform its oversight duties adequately. As a result, Chanute's customers' best interests (e.g., curricula, training aids, and facilities) may not be addressed in a timely manner.

Finally, Chanute has successfully implemented two technologically advanced training media: computer-based instruction (CBI) and distance-learning via satellite. Chanute uses these training media more extensively than the civilian training organizations visited by the researchers.

### Recommendations

Fundamental to the military training philosophy is on-the-job training. The Chanute apprentice receives broad exposure to maintenance training with minimal depth during the fifty-seven days of instruction. Once the apprentice moves on to the field, on-the-job training becomes the primary means of training, led by the apprentice's supervisor. AFM 77-310, Volume II, Chapter 5, provides general guidance on establishing base-level on-the-job

training. This general guidance allows for a wide variety of training programs from base to base. One area of further research could be, "Is there consistent application throughout the Air Force of the regulation in establishing on-the-job training programs" (i.e., is the five-level training at one base consistent with another base, or do some bases train apprentices better than others)?

In conducting the NATEF self-evaluation certification process, our research looked at only one of four apprenticeship level training programs. Just recently, NATEF developed a certification for heavy equipment/truck training programs (53). This new certification emphasizes diesel engines and hydraulic systems. The other three entry-level programs, special purpose, refueling, and crash/fire, could be reviewed for certification under NATEF's new program.

Not only does the civilian industry recognize maintenance training program certification, but also individual technician certification through ASE. Through the course of this research, the researchers discovered that some Air Force mechanics seek ASE-certification for their personal professional development. For example, through Chanute's education office, automotive instructors can take ASE-certification examinations. One area for further study is, "Should the Air Force seek to certify its

qualified mechanics through ASE, and would this have any impact on vehicle readiness"?

### Chapter Summary

This chapter summarized the three gaps and further findings identified through this study, and presented ideas for further research. As identified in the literature review, the realm of automotive training in the civilian industry is very broad. If the military is a subset of the civilian community, it should not operate independently. This thesis attempted to close the information gap between a small portion of the training communities.

The researchers' study discovered the industry's best practice is NATEF-certification. The NATEF certification process establishes minimum standards, which are likely to produce a better trained mechanic. The current Air Force GP training program is not capable of meeting NATEF's minimum standards. However, there are elements that the Air Force could consider for adaptation:

- (1) Increased frequency of advisory committee meetings;
- (2) Greater use of opportunities for instructors to return to the civilian industry for upgrade training; and
- (3) Better acquisition procedures for late-model vehicle training aids.

With the downsizing of the force and Chanute's pending move to Lackland AFB, now is the time for implementation of industry's best practice.

Appendix A: Chanute Plan of Instruction for  
Apprentice General Purpose Vehicle Mechanic

POI C3A3R47232 000  
(PDS Code AD5)

PLAN OF INSTRUCTION  
(Technical Training)

APPRENTICE GENERAL PURPOSE VEHICLE MECHANIC



CHANUTE TECHNICAL TRAINING CENTER

17 April 1992 - Effective 17 April 1992 with class 920417  
and all classes on board

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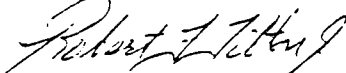
DEPARTMENT OF THE AIR FORCE  
3330 TECHNICAL TRAINING WING (ATC)  
CHANUTE AIR FORCE BASE, ILLINOIS 61868-5000

PLAN OF INSTRUCTION C3ABR47232 000  
(PDS Code AD5)  
17 April 1992

#### FOREWORD

1. **PURPOSE:** This publication is the plan of instruction (POI) when the pages listed on page A are bound into a single volume. When separated into units of instruction, it becomes the lesson plan/part I. The POI contains the qualitative requirements for course C3ABR47232 000, Apprentice General Purpose Vehicle Mechanic, in terms of objectives for each unit of instruction and shows planned time, training standard correlation, and support materials and guidance. This POI was developed according to ATCR 52-15.
2. **COURSE DESIGN/DESCRIPTION:** The instructional design for this course is Group Paced. This course trains airmen to perform duties prescribed in AFR 39-1 for Apprentice General Purpose Vehicle Mechanic, AFSC 47232. Training includes inspecting, maintaining, testing, adjusting, troubleshooting and repairing automotive general purpose vehicles; gasolines and diesel engines; electrical, heating/air conditioning, and hydraulic systems; power trains, suspension, steering and brake systems; computer and emission control systems; distributor fuel pumps and pressure time fuel systems. Training is also provided on career progression, security, safety, maintenance management, materiel control, maintenance publications, maintenance policies and procedures and the use of tools and test equipment. Military training is provided in the form of commander's calls and predeparture safety briefing.
3. **REFERENCES:** This POI is based on Specialty Training Standard 472X2, April 1987, and Course Chart C3ABR47232 000, 6 August 1990.
4. **TRAINING EQUIPMENT:** The number shown in parentheses after equipment listed as Training Equipment under SUPPORT MATERIALS AND GUIDANCE is the planned number of students assigned to each equipment unit.

FOR THE COMMANDER



ROBERT F. TILTON, JR., Colonel, USAF  
Commander, 3340 Technical Training Group

Supersedes POI C3ABR47232 000, 1 May 1991.  
OPR: 3340 Technical Training Group  
Prepared by: Herbert J. McClain  
DISTRIBUTION: Listed on page A

PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Vehicle Maintenance Associated Subjects				
1.	COURSE CONTENT			2. TIME
1.	Orientation			1
	a. School orientation conducted IAW WR 50-2, Attachment 4.			
	STS: None Meas: None			
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE    Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE Vehicle Maintenance Associated Subjects				
1.	COURSE CONTENT			2. TIME
	2. Introduction to Computer Based Training (CBT)			1
	a. Operation of CBT keyboard.    STS: None    Meas: None			
SUPERVISOR APPROVAL OF LESSON PLAN				
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Vehicle Maintenance Associated Subjects				
1.	COURSE CONTENT			2. TIME
4.	Security			4
	a. Given a list of five (5) statements and related responses pertaining to security classifications of information, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>2a(1)</u> Meas: W and PC Proficiency Level: A			(1)
	b. Given a list of five (5) statements and related responses pertaining to the use of MAJCOM/SOAs SEFIs, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>2a(2)</u> Meas: W and PC Proficiency Level: A			(1)
	c. Given a list of five (5) statements and related responses pertaining to the prevention of security violations, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>2a(3)</u> Meas: W and PC Proficiency Level: A			(1)
	d. Given a list of five (5) statements and related responses pertaining to specific OPSEC vulnerabilities of AFSC 472XX, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>2b(6)</u> Meas: W and PC Proficiency Level: A			(1)
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Vehicle Maintenance Associated Subjects				
1. COURSE CONTENT				2. TIME
5. AF Occupational Safety and Health (AFOSH) Program				7.5
a. Given a list of five (5) statements and related responses pertaining to personnel and shop safety, without reference, select the correct response for each statement; four (4) of the five (5) must be correct. STS: 3a Meas: W and PC				(2)
b. Given a list of ten (10) statements and related responses pertaining to the hazards of AFSC 472XX, without reference, identify the correct response for each statement; eight (8) of the ten (10) must be correct. STS: 3b Meas: W and PC Proficiency Level: A				(2)
c. Complete Federal Hazard Communication Training Program (FHCTP) Workbook. STS: 3d Meas: FHCTP Workbook Proficiency Level: A				(3.5)
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Vehicle Maintenance Associated Subjects				
1.	COURSE CONTENT			2. TIME
6.	Vehicle Maintenance Publications (Standard and Technical Orders)			19
	a. Given a list of five (5) statements and related responses pertaining to the use of the Standard Publication System, without reference, identify the correct response for each statement; four (4) of five (5) must be correct. STS: <u>5a</u> Meas: W and PC Proficiency Level: A			(2)
	b. Given ten (10) statements and related responses pertaining to the use of the Technical Order System, without reference. identify the correct response for each statement; eight (8) of ten (10) must be correct. STS: <u>5b</u> Meas: W and PC Proficiency Level: A			(4)
	c. Given a technical publication, microfiche, viewer, and a list of technical order subjects, locate specific information on the subjects; eight (8) out of ten (10) must be correct, with no more than two (2) instructor assists. STS: <u>5d</u> Meas: PC Proficiency Level: 2b			(13)
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE Vehicle Maintenance Associated Subjects				
1. COURSE CONTENT				2. TIME
7. Vehicle Maintenance (Material Control)				5
a. Given a list of five (5) statements and related responses pertaining to property responsibility and accountability, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>6a</u> Meas: W and PC Proficiency Level: A				(1)
b. Given a list of five (5) statements and related responses pertaining to cross-referencing part/stock numbers, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>6b</u> Meas: W and PC				(1)
c. Given microfiche, viewer, and a list of part and stock numbers, cross-reference the part and stock numbers; six (6) out of ten (10) must be correct, with no more than three (3) instructor assists. STS: <u>6b</u> Meas: PC Proficiency Level: 1a				(3)
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE Vehicle Maintenance Associated Subjects				
1.		COURSE CONTENT		2. TIME
8.		Vehicle Maintenance Management		4
		a. Given a list of five (5) statements and related responses pertaining to functions of transportation management units, without reference, select the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>7a</u> Meas: W and PC Proficiency Level: A		(1)
		b. Given a list of five (5) responsibilities of vehicle maintenance staff and their related staff agencies, identify the agency that performs the responsibility; four (4) of the five (5) must be correct. STS: <u>7b</u> Meas: W and PC Proficiency Level: A		(1)
		c. Given a list of ten (10) duties and related workcenters pertaining to the functions of vehicle maintenance units, without reference, select the correct duty to its proper workcenter; eight (8) of the ten (10) must be correct. STS: <u>7c</u> Meas: W and PC Proficiency Level: A		(2)
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Vehicle Maintenance Associated Subjects				
1. COURSE CONTENT				2. TIME
9. Special Maintenance Policies and Procedures				5
a. Given a list of five (5) statements and related responses pertaining to corrosion control procedures, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>9b</u> Meas: W and PC Proficiency Level: a				(1.5)
b. Give a list of five (5) statements and related responses pertaining to preparation of vehicles for storage, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>9c</u> Meas: W and PC Proficiency Level: a				(1)
c. Given a list of five (5) statements and related responses pertaining to preparation of vehicles for shipment, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>9d</u> Meas: W and PC Proficiency Level: a				(.5)
d. Given a list of five (5) statements and related responses pertaining to the Materiel Deficiency Reporting System, without reference, identify the correct response for each statement; four (4) of the five (5) must be correct. STS: <u>9e</u> Meas: W and PC Proficiency Level: A				(1.5)
e. Given a list of five (5) statements pertaining to Warranty Compliance Policies, without reference, select the statements that are correct; four (4) of the five (5) must be correct. STS: <u>9f</u> Meas: W and PC Proficiency Level: a				(.5)
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BLOCK TITLE Vehicle Maintenance Associated Subjects				
1. COURSE CONTENT		2. TIME		
10. Use Tools and Test Equipment  a. Given a list of twenty (20) tools/test equipment and a list of uses, without reference, correctly select each tool/test equipment to its use; at least sixteen (16) of twenty (20) must be selected correctly. STS: 10 Meas: W and PC		8		
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Gasoline and Diesel Engines				
1.	COURSE CONTENT			2. TIME
1.	Gasoline Engine Operation			6
	a. Given eight (8) phrases and responses relating to the operation of gasoline engines, without reference, select the best response for each phrase. Six (6) out of eight (8) must be selected correctly. STS: <u>12a</u> Meas: W and PC Proficiency Level: B			
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NAME OF INSTRUCTOR		COURSE TITLE Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Gasoline and Diesel Engines				
COURSE CONTENT				TIME
1.				
2. Disassemble, Inspect, and Reassemble Engine				19
a. Given an engine trainer and tools, as a team member, disassemble the engine IAW manufacturer's procedures, specifications, and safety practices, with no more than four (4) instructor assists. STS: <u>12c</u> Meas: PC Proficiency Level: 2b				(8)
b. Given a disassembled engine trainer and tools, as a team member, inspect engine parts IAW manufacturer's procedures, specifications, and safety practices, with no more than four (4) instructor assists. STS: <u>12d</u> Meas: PC Proficiency Level: 2b				(3)
c. Given a disassembled engine trainer, tools and test equipment, as a team member, reassemble the engine IAW manufacturer's procedures, specifications, and safety practices with no more than four (4) instructor assists. STS: <u>12e</u> Meas: PC Proficiency Level: 2b				(8)
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Gasoline and Diesel Engines				
1. COURSE CONTENT				2. TIME
3. Exhaust System, Valve Train, and Cooling System				12
a. Given an engine trainer and tools, as a team member, inspect the engine exhaust system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>13i</u> Meas: PC Proficiency Level: 2b				(1)
b. Given an engine trainer and tools, as a team member, maintain the engine exhaust system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>12h(6)</u> , <u>13h(7)</u> Meas: PC Proficiency Level: 2b				(1)
c. Given an engine trainer, test equipment, and tools, as a team member, troubleshoot the valve train IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>12g(1)</u> Meas: PC Proficiency Level: 2b				(3)
d. Given an engine trainer, test equipment, and tools, as a team member, maintain the valve train IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>12h(1)</u> Meas: PC Proficiency Level: 2b				(2)
e. Given an engine trainer, test equipment, and tools, as a member, troubleshoot the engine cooling system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>12g(2)</u> , <u>13g(2)</u> Meas: PC Proficiency Level: 2b				(2.5)
f. Given an engine trainer, test equipment, and tools, as a team member, maintain the engine cooling system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>9a</u> , <u>12h(2)</u> , <u>13h(2)</u> Meas: PC Proficiency Level: 2b				(2.5)
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NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Gasoline and Diesel Engines				
1. COURSE CONTENT				2. TIME
4. Lubrication System, Air/Fuel System, and Emission Controls				13
a. Given an engine trainer and tools, as a team member, troubleshoot the engine lubrication system IAW manufacturer's procedures, specifications, and safety practices with no more than two (2) instructor assists. STS: <u>13g(5)</u> Meas: PC Proficiency Level: 2b				(1)
b. Given an engine trainer and tools, as a team member, maintain the engine lubrication system IAW manufacturer's procedures, specifications, and safety practices with no more than two (2) instructor assists. STS: <u>12h(5)</u> , <u>13h(6)</u> Meas: PC Proficiency Level: 2b				(1)
c. Given an engine trainer, test equipment, and tools, as a team member, troubleshoot the air/fuel system IAW manufacturer's procedures, specifications, and safety practices with no more than two (2) instructor assists. STS: <u>12g(3)</u> Meas: PC Proficiency Level: 2b				(3.5)
d. Given an engine trainer, test equipment, and tools, as a team member, maintain the air/fuel system IAW manufacturer's procedures, specifications, and safety practices with no more than two (2) instructor assists. STS: <u>12h(3)</u> Meas: PC Proficiency Level: 2b				(1.5)
e. Given an engine trainer, test equipment, and tools, as a team member, troubleshoot the emission control system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>12g(4)</u> , <u>13g(5)</u> Meas: PC Proficiency Level: 2b				(4)
f. Given an engine trainer, test equipment, and tools, as a team member, maintain the emission control system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>12h(4)</u> , <u>13h(5)</u> Meas: PC Proficiency Level: 2b				(2)
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NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Gasoline and Diesel Engines				
COURSE CONTENT				2. TIME
1. Diesel Engines  a. Given a list of phrases and related responses pertaining to the operation of diesel engines, without reference, select the response that best completes the phrase. At least eight (8) of ten (10) must be answered correctly. STS: 13a Meas: W and PC Proficiency Level: B				4.5
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NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Gasoline and Diesel Engines				
1.	COURSE CONTENT			2. TIME
7.	Disassemble, Inspect, and Reassemble a Diesel Engine			16
	a. Given a 6.2 liter diesel engine, tools, and technical order, as a team member disassemble the engine IAW TO procedures, specifications, and safety practices, with a maximum of three (3) instructor assists. STS: <u>13c</u> Meas: PC Proficiency Level: 2b			(6)
	b. Given a 6.2 liter diesel engine, tools, and technical order, as a team member inspect engine parts IAW TO procedures, specifications, and safety practices with a maximum of two (2) instructor assists. STS: <u>13d</u> Meas: PC Proficiency Level: 2b			(4)
	c. Given a 6.2 liter diesel engine, tools, and technical order, as a team member reassemble the engine IAW TO procedures, specifications, and safety practices with a maximum of three (3) instructor assists. STS: <u>13e</u> Meas: PC Proficiency Level: 2b			(6)
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Gasoline and Diesel Engines				
1.	COURSE CONTENT			2. TIME
3.	Unit Injection Fuel System			19.5
a.	Given a diesel engine, tools, test equipment, and applicable technical order, as a team member troubleshoot the air system IAW TO procedures, specifications, and safety practices with a maximum of one (1) instructor assist. STS: <u>13g(4)</u> Meas: PC Proficiency Level: 2b			(2.5)
b.	Given a diesel engine, and tools, as a team member, maintain the air system IAW manufacturer's procedures, specifications, and safety practices with a maximum of one (1) instructor assist. STS: <u>13h(4)</u> Meas: PC Proficiency Level: 2b			(2.5)
c.	Given a diesel engine, tools, and applicable technical order, as a team member, troubleshoot the fuel system IAW TO procedures, specifications, and safety practices with a maximum of two (2) instructor assists. STS: <u>13g(3)</u> Meas: PC			(2.5)
d.	Given a diesel engine, tools, and applicable technical order, as a team member, troubleshoot to maintain the valve train system IAW TO procedures, specifications, and safety practices with a maximum of one (1) instructor assists. STS: <u>13g(1)</u> , <u>13h(1)</u> Meas: PC Proficiency Level: 2b			(5.5)
e.	Given a diesel engine, tools, and applicable technical order, as a team member, adjust the unit injection system IAW TO procedures, specifications, and safety practices with a maximum of three (3) instructor assists. STS: <u>13h(3)</u> Meas: PC			(6.5)
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NAME OF INSTRUCTOR		COURSE TITLE Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE Gasoline and Diesel Engines				
1.	COURSE CONTENT			2. TIME
9. Multiple Pump Fuel System				16
a. Given a diesel engine, and tools, as a team member, troubleshoot the fuel system IAW the manufacturer's procedures, specifications, and safety practices with a maximum of one (1) instructor assist. STS: <u>13g(3)</u> Meas: PC Proficiency Level: 2b				(3)
b. Given a diesel engine, tools, and applicable technical order, as a team member, maintain the valve train system IAW TO procedures, specifications, and safety practices with a maximum of two (2) instructor assists. STS: 13h(1) Meas: PC				(13)
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE: Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE: Electrical, Heating/Air Conditioning, and Hydraulics				
1. COURSE CONTENT		2. TIME		
1. Fundamentals of Electricity		16		
a. Given ten (10) statements and related responses concerning the Fundamentals of Electricity, without reference, select the response that completes the statement, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14a</u> Meas: W and PC Proficiency Level: B		(4)		
b. Given a list of ten (10) terms and a list of symbols concerning the Fundamentals of Electricity, without reference, correctly select the terms that match the symbols, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14b</u> Meas: W and PC		(3)		
c. Given an electrical schematic, and a circuit board trainer, assemble an electrical circuit IAW trainer instructions and safety practices with a maximum of two (2) instructor assists. STS: <u>14b</u> Meas: PC Proficiency Level: 2b		(9)		
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE Electrical, Heating/Air Conditioning, and Hydraulics				
1. COURSE CONTENT		2. TIME		
2. Vehicle Batteries		8		
a. Given ten (10) statements and related responses concerning the operation of vehicle batteries, without reference, select the response that completes the statement, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14c(1)</u> Meas: W and PC Proficiency Level: B		(3)		
b. Given technical publications, tools, test equipment, and a battery, as a team member, troubleshoot the battery IAW technical publication, specifications, and safety practices with a maximum of three (3) instructor assists. STS: <u>14d(1)</u> Meas: PC Proficiency Level: 2b		(2)		
c. Given tools, and a battery, as a team member, maintain the battery IAW manufacturer's procedures, specifications, and safety practices with a maximum of two (2) instructor assists. STS: <u>14e(1)</u> Meas: PC Proficiency Level: 2b		(3)		
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NAME OF INSTRUCTOR		COURSE TITLE		
		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Electrical, Heating/Air Conditioning, and Hydraulics				
1. COURSE CONTENT				2. TIME
3. Starting Systems  a. Given ten (10) statements and related responses concerning the operating principles of the starting system, without reference, select the response that completes the statement, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14c(2)</u> Meas: W and PC Proficiency Level: B  b. Given an engine trainer, technical publication, tools and test equipment, as a team member, troubleshoot the starting system IAW technical publication, manufacturer's procedures and safety practices with a maximum of two (2) instructor assists. STS: <u>14d(2)</u> Meas: PC Proficiency Level: 2b  c. Given an engine trainer, technical publication and tools, as a team member, maintain the starting system IAW technical publication, specifications and safety practices with a maximum of two (2) instructor assists. STS: <u>14e(2)</u> Meas: PC Proficiency Level: 2b				9  (3)  (3.5)  (2.5)
SUPERVISOR APPROVAL OF LESSON PLAN				
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		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Electrical, Heating/Air Conditioning, and Hydraulics				
1. COURSE CONTENT				2. TIME
4. AC Charging Systems				8
a. Given ten (10) statements and related responses concerning the operating principles of the AC charging system, without reference, select the response that completes the statement, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14c(3)(b)</u> Meas: W and PC Proficiency Level: B				(3)
b. Given technical publications, tools, test equipment, and an engine trainer, as a team member, troubleshoot the AC charging system IAW technical publication, specifications, and safety practices with a maximum of three (3) instructor assists. STS: <u>14d(3)(b)</u> Meas: PC Proficiency Level: 2b				(2.5)
c. Given technical publication, tools, test equipment, and an engine trainer, as a team member, maintain the AC charging system IAW technical publication, specification, and safety practices with a maximum of three (3) instructor assists. STS: <u>14e(3)(b)</u> Meas: PC Proficiency Level: 2b				(2.5)
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BLOCK TITLE				
Electrical, Heating/Air Conditioning, and Hydraulics				
1. COURSE CONTENT				2. TIME
5. Solid State Ignition Systems				16
a. Given ten (10) statements and related responses concerning the operation of the solid state ignition system, without reference, select the response that completes the statement, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14c(4)(b)</u> Meas: W and PC Proficiency Level: B				(2)
b. Given tools, test equipment, and an engine trainer, as a team member, troubleshoot the solid state ignition system IAW technical publication, specifications, and safety practices, with a maximum of three (3) instructor assists. STS: <u>14d(4)(b)</u> Meas: PC Proficiency Level: 2b				(4.5)
c. Given tools, test equipment, and an engine trainer, as a team member, maintain the solid state ignition system IAW technical publication, specifications, and safety practices, with a maximum of three (3) instructor assists. STS: <u>14e(4)(b)</u> Meas: PC Proficiency Level: 2b				(1.5)
d. Given ten (10) statements and related responses concerning the computer control system, without reference, select the response that completes the statement, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14c(7)</u> Meas: W and PC				(3)
e. Given a vehicle, as a team member, troubleshoot to maintain the computer control system, IAW manufacturer's procedures and safety practices, with no more than two (2) instructor assists. STS: <u>14d(7)</u> , <u>14e(7)</u> Meas: PC				(5)
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NAME OF INSTRUCTOR		COURSE TITLE    Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE Electrical, Heating/Air Conditioning, and Hydraulics				
1.	COURSE CONTENT		2.	TIME
	<p>6. Lighting and Warning Systems</p> <p style="margin-left: 20px;">a. Given ten (10) statements and related responses concerning the operation of the lighting system, without reference, select the response that completes the statement, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14c(5)</u> Meas: W and PC Proficiency Level: B</p> <p style="margin-left: 20px;">b. Given tools, test equipment, lighting and warning system trainer, as a team member, troubleshoot the lighting system IAW manufacturer's procedures, specifications, and safety practices with a maximum of two (2) instructor assists. STS: <u>14d(5)</u> Meas: PC Proficiency Level: 2b</p> <p style="margin-left: 20px;">c. Given a vehicle, and tools, as a team member, maintain the lighting system IAW manufacturer's procedures, specifications, and safety practices with a maximum of two (2) instructor assists. STS: <u>14e(5)</u> Meas: PC Proficiency Level: 2b</p> <p style="margin-left: 20px;">d. Given ten (10) statements and related responses concerning the operation of the warning system, select the response that completes the statement, at least seven (7) of the ten (10) must be selected correctly. STS: <u>14c(6)</u> Meas: W and PC Proficiency Level: B</p> <p style="margin-left: 20px;">e. Given a vehicle, tools, and test equipment, as a team member, troubleshoot to maintain the warning system IAW manufacturer's specifications, and safety practices with a maximum of three (3) instructor assists. STS: <u>14d(6)</u>, <u>14e(6)</u> Meas: PC Proficiency Level: 2b</p>		<p>7</p> <p>(1)</p> <p>(2)</p> <p>(1)</p> <p>(1)</p> <p>(2)</p>	
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		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Electrical, Heating/Air Conditioning, and Hydraulics				
1. COURSE CONTENT				2. TIME
8. Heating/Air Conditioning System				16
a. Given ten (10) phrases and responses relating to the operation of the heating/air conditioning system, without reference, select the best response for each phrase. Seven (7) out of ten (10) must be selected correctly. STS: <u>20a</u> Meas: W and PC Proficiency Level: B				(6)
b. Given a trainer and flow chart, troubleshoot the air conditioning trainer IAW flow chart procedures and safety practices with no more than two (2) instructor assists. STS: <u>20b(2)</u> Meas: PC Proficiency Level: 1b				(3)
c. Given a vehicle, tools and test equipment, as a team member, maintain the air conditioning system IAW manufacturer's procedures, specifications, and safety practices with NO more than three (3) instructor assists. STS: <u>20c(2)</u> Meas: PC Proficiency Level: 1b				(3)
d. Given a trainer and flow chart, troubleshoot to maintain the heating trainer IAW flow chart procedures and safety practices, with no more than three (3) instructor assists. STS: <u>20b(1)</u> , <u>20c(1)</u> Meas: PC Proficiency Level: 2b				(4)
SUPPORT MATERIALS AND GUIDANCE				
<u>Student Instructional Materials</u> Modern Automotive Mechanics and Workbook C3ABR472XX 000-HO-308, Basic Air Conditioning				
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BLOCK TITLE Electrical, Heating/Air Conditioning, and Hydraulics				
1.	COURSE CONTENT	2.	TIME	
9.	Hydraulic Systems	16		
	a. Given ten (10) phrases and responses about the fundamentals of hydraulic systems, without reference, correctly select the response that completes the phrase. Seven (7) out of ten (10) responses must be correct. STS: <u>15a</u> Meas: W and PC Proficiency Level: B	(5)		
	b. Given a hydraulic diagram, and a list of components, correctly identify seven (7) out of ten (10) components with no more than one (1) instructor assist. STS: <u>15b</u> Meas: W and PC	(2)		
	c. Given five (5) hydraulic schematics, and color markers, correctly trace the fluid flow IAW instructions, with no more than two (2) instructor assists per schematic. Four (4) out of five (5) schematics must be traced correctly. STS: <u>15b</u> Meas: PC Proficiency Level: 2b	(3)		
	d. Using a trainer, and tools, as a team member, maintain the hydraulic system's filters/strainers IAW manufacturer's procedures, specifications and safety practices with no more than two (2) instructor assists. STS: <u>15d(4)</u> Meas: PC Proficiency Level: 2b	(.5)		
	e. Using a trainer, and tools, as a team member, maintain the hydraulic system's accumulator IAW manufacturer's procedures, specifications and safety practices with no more than two (2) instructor assists. STS: <u>15d(6)</u> Meas: PC Proficiency Level: 2b	(.5)		
	f. Using a trainer, and tools, as a team member, maintain the hydraulic system's fittings and lines IAW manufacturer's procedures, specifications and safety practices with no more than one (1) instructor assist. STS: <u>15d(5)</u> Meas: PC Proficiency Level: 2b	(.5)		
	g. Using a trainer, and tools, as a team member, maintain the hydraulic system pump(s) IAW manufacturer's procedures, specifications, and safety practices with no more than one (1) instructor assist. STS: <u>15d(1)</u> Meas: PC Proficiency Level: 2b	(.5)		
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PLAN OF INSTRUCTION/LESSON PLAN PART I				
NAME OF INSTRUCTOR		COURSE TITLE    Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1. COURSE CONTENT		2. TIME		
1. Suspension Systems  a. Given ten (10) statements and related responses about the function of the suspension systems, without reference, identify the correct response for each statement. At least eight (8) out of ten (10) must be answered correctly. STS: <u>17a</u> Meas: W and PC Proficiency Level: B  b. Given a vehicle, tools, and equipment, as a team member, inspect the suspension system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>17b</u> Meas: PC Proficiency Level: 2b  c. Given a vehicle, tools, and equipment, remove a shock absorber IAW manufacturer's procedures, specifications, and safety practices, with no more than one (1) instructor assist. STS: <u>17c</u> Meas: PC Proficiency Level: 1b  d. Given a vehicle, tools, and equipment, install a shock absorber, IAW manufacturer's procedures, specifications, and safety practices, with no more than one (1) instructor assist. STS: <u>17d</u> Meas: PC Proficiency Level: 1b  e. Given a wheel bearing, pack the wheel bearing IAW packing procedures and safety practices, with no more than two (2) instructor assists. STS: <u>17e</u> Meas: PC Proficiency Level: 2b		13.5  (7)  (2.5)  (1)  (1)  (2)		
SUPPORT MATERIALS AND GUIDANCE  <u>Student Instructional Materials</u> Modern Automotive Mechanics and Workbook  <u>Audiovisual Aids</u> Transparency Set: Suspension System and Frames Film 611004B, ABC's of Automotive Chassis				
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BLOCK TITLE				
Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1.	COURSE CONTENT			2. TIME
2.	Steering Systems			16.5
	<p>a. Given ten (10) statements and related responses about the functions of the steering systems, without reference, select the correct response for the statement. At least eight (8) out of ten (10) must be correct. STS: <u>18a</u> Meas: W and PC Proficiency Level: B</p>			(6.5)
	<p>b. Given a vehicle, tools, and equipment, as a team member, inspect the steering system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>18b</u> Meas: PC Proficiency Level: 2b</p>			(2)
	<p>c. Given applicable technical order and a list of steps for removing a steering gear, arrange the steps in the logical sequence, at least three (3) out of five (5) steps must be correct. STS: <u>18c</u> Meas: W and PC Proficiency Level: b</p>			(1)
	<p>d. Given applicable technical order and a list of steps for installing a steering gear, arrange the steps in the logical sequence, at least three (3) out of five (5) steps must be correct. STS: <u>18d</u> Meas: W and PC Proficiency Level: b</p>			(1)
	<p>e. Given five (5) statements and related responses about steering system troubleshooting procedures, without reference, select the response that completes the statement, at least four (4) out of five (5) must be correct. STS: <u>18e</u> Meas: W and PC Proficiency Level: b</p>			(2)
	<p>f. Given a vehicle, tools, equipment, and technical order, as a team member, adjust a steering gear IAW technical order procedures, specification, and safety practices, with no more than two (2) instructor assists. STS: <u>18f</u> Meas: PC Proficiency Level: 2b</p>			(4)
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BLOCK TITLE Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1. COURSE CONTENT		2. TIME		
3. Clutches		6		
a. Given five (5) statements and related responses about the operation of the clutch, without reference select the correct response for each statement. At least three (3) of the five (5) statements must be selected correctly. STS: 16a Meas: W and PC		(3)		
b. Given a vehicle, and tools, as a team member, troubleshoot to maintain a clutch IAW manufacturer's procedures, specifications, and safety practices, with a maximum of two (2) instructor assists. STS: 16b, 16c(2) Meas: PC Proficiency Level: 2b		(3)		
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NAME OF INSTRUCTOR		COURSE TITLE Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1. COURSE CONTENT		2. TIME		
4. Transmissions		12		
a. Given eight (8) statements and related responses about the operation of the transmission, without reference select the correct response for each statement. At least six (6) of the eight (8) statements must be selected correctly. STS: 16a Meas: W and PC		(8)		
b. Given a vehicle, tools, and technical order, as a team member, troubleshoot to maintain an automatic transmission IAW manufacturer's procedures, specifications, and safety practices, with a maximum of two (2) instructor assists. STS: 16b, <u>16c(1)</u> Meas: PC Proficiency Level: 2b		(4)		
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		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1.	COURSE CONTENT			2. TIME
5.	Transfer Case/Auxiliary Gear Box			4.5
	a. Given five (5) statements and related responses about the operation of the transfer case/auxiliary gear box, without reference, select the correct response for each statement. At least three (3) of the five (5) statements must be selected correctly. STS: 16a Meas: W and PC			(2.5)
	b. Given a vehicle, and tools, as a team member, troubleshoot to maintain a transfer case/auxiliary gear box, IAW manufacturer's procedures, specifications, and safety practices, with a maximum of two (2) instructor assists. STS: 16b, <u>16c(3)</u> Meas: PC Proficiency Level: 2b			(2)
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		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1.	COURSE CONTENT			2. TIME
7.	Drive Train (Drive Shaft)			3.5
	a. Given five (5) statements and related responses about the operation of the drive train (drive shaft), without reference, select the correct response for each statement. At least four (4) of the five (5) statements must be selected correctly. STS: 16a Meas: W and PC			(1.5)
	b. Given a vehicle, and tools, as a team member, troubleshoot to maintain the drive train (drive shaft) IAW manufacturer's procedures, specifications, and safety practices, with a maximum of two (2) instructor assists. STS: 16b, <u>16c(5)</u> Meas: PC Proficiency Level: 2b			(2)
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		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1. COURSE CONTENT		2. TIME		
8. Drive Axle		7		
<p>a. Given five (5) statements and related responses about the operation of the drive axle assembly, without reference, select the correct response for each statement. At least four (4) of the five (5) statements must be selected correctly. STS: <u>16a</u> Meas: W and PC Proficiency Level: B</p>		(4)		
<p>b. Given a vehicle, tools, and equipment, as a team member, troubleshoot to maintain the drive axle assembly IAW manufacturer's procedures, specifications and safety practices, with a maximum of two (2) instructor assists. STS: <u>16b</u>, <u>16c(4)</u> Meas: PC Proficiency Level: 2b</p>		(3)		
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BLOCK TITLE Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1. COURSE CONTENT				2. TIME
9. Wheels and Tires  a. Given five (5) statements and related responses about the procedures for maintaining wheels and tires, without reference select the correct response for each statement. At least four (4) of the five (5) statements must be selected correctly. STS: <u>16c(6)</u> Meas: W and PC Proficiency Level: b				4
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BLOCK TITLE				
Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1. COURSE CONTENT				2. TIME
10. Brake Systems				15.5
a. Given ten (10) statements and related responses on operating principles of hydraulic brake, without reference, select the correct response for each statement. At least seven (7) out of ten (10) must be correct. STS: 19a Meas: W and PC				(7.5)
b. Given a vehicle, tools, technical order, and equipment, as a team member, troubleshoot a hydraulic brake system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: 19b(1) Meas: PC Proficiency Level: 2b				(2)
c. Given a vehicle, tools, technical order, and equipment, as a team member, maintain a rear drum brake assembly IAW manufacturer's procedures, specifications, and safety practices with no more than two (2) instructor assists. STS: 19c(1) Meas: PC Proficiency Level: 2b				(3)
d. Given a vehicle, tools, and equipment, as a team member, troubleshoot a power assisted brake system IAW manufacturer's procedures, specifications, and safety practices, with no more than three (3) instructor assists. STS: 19b(4) Meas: PC Proficiency Level: 1b				(1)
e. Given a vehicle, tools, equipment, and technical order, as a team member, maintain a power assisted hydraulic brake system IAW manufacturer's procedures, specifications, and safety practices with no more than two (2) instructor assists. STS: 19c(4) Meas: PC Proficiency Level: 2b				(2)
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		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1.	COURSE CONTENT			2. TIME
11.	Air Brakes			8
	a. Given ten (10) statements and related responses on the operation of air brakes, without reference, identify the correct response for each statement. At least seven (7) out of ten (10) must be correct. STS: <u>19a</u> Meas: W and PC Proficiency Level: 3			(4)
	b. Given a vehicle, tools, and equipment, as a team member, troubleshoot the air brake system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>19b(2)</u> Meas: PC Proficiency Level: 2b			(2.5)
	c. Given a vehicle, tools, and equipment, as a team member, maintain the air brake system IAW manufacturer's procedures, specifications, and safety practices, with no more than two (2) instructor assists. STS: <u>19c(2)</u> Meas: PC Proficiency Level: 2b			(1.5)
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		Apprentice General Purpose Vehicle Mechanic		
BLOCK TITLE				
Power Train, Suspension, Steering, Brakes, Maintenance and Inspection				
1. COURSE CONTENT				2. TIME
12. Maintenance and Inspections				8
a. Given a list of four (4) statements and related responses pertaining to vehicle operator's inspections, without reference, identify the correct response for each statement; three (3) of the four (4) must be correct. STS: <u>11a</u> Meas: W and PC Proficiency Level: a				(2)
b. Given a list of four (4) statements and related responses pertaining to vehicle annual inspections, without reference, identify the correct response for each statement; three (3) of the four (4) must be correct. STS: <u>11c</u> Meas: W and PC Proficiency Level: a				(1)
c. Given a list of four (4) statements and related responses pertaining to vehicle special inspections, without reference, identify the correct response for each statement; three (3) of the four (4) must be correct. STS: <u>11d</u> Meas: W and PC Proficiency Level: a				(1)
d. Given a list of four (4) statements and related responses pertaining to vehicle technical inspections, without reference, identify the correct response for each statement; three (3) of the four (4) must be correct. STS: <u>11e</u> Meas: W and PC Proficiency Level: a				(1)
e. Given a vehicle, perform a scheduled inspection IAW the checklist procedures and safety practices with a maximum of two (2) instructor assists. STS: <u>11b</u> Meas: PC Proficiency Level: 2b				(3)
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PLAN OF INSTRUCTION/LESSON PLAN PART I																				
NAME OF INSTRUCTOR		COURSE TITLE																		
		Apprentice General Purpose Vehicle Mechanic																		
BLOCK TITLE																				
General Purpose Engines/Chassis																				
1.		COURSE CONTENT		2. TIME																
1.		Distributor Fuel Pump		24																
		a. Given a diesel engine, tools and technical manual, as a team member, time the pump IAW technical manual procedures, specifications and safety practices with no more than four (4) instructor assists. STS: 13h(3) Meas: PC		(24)																
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PLAN OF INSTRUCTION/LESSON PLAN PART I																				
NAME OF INSTRUCTOR		COURSE TITLE																		
		Apprentice General Purpose Vehicle Mechanic																		
BLOCK TITLE																				
General Purpose Engines/Chassis																				
1.	COURSE CONTENT			2. TIME																
2.	Pressure Time Fuel Systems  a. Given a diesel engine, tools, and technical order, as a team member, perform tune-up procedures on a PT fuel system IAW the technical order specifications and safety practices with no more than three (3) instructor assists. STS: <u>13h(1)</u> , 13h(3) Meas: PC Proficiency Level: 2b			17  (17)																
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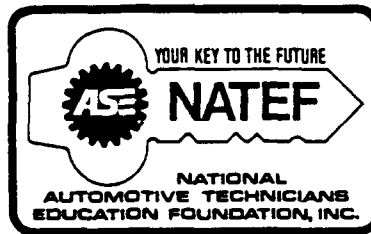
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## Appendix B: NATEF Self-Evaluation Material



To: Administrators and Instructors Obtaining Materials for  
Self-Evaluation of Automotive Technician Training to  
Prepare for Program Certification by the National  
Institute for Automotive Service Excellence (ASE)

FROM: Ron Weiner  
President, ASE, and Administrator, NATEF

SUBJECT: Conducting the Self-Study

You have taken the first step in the process to qualify your automotive technician training program for ASE certification. Please note that NATEF is a part of ASE. NATEF will be leading you through the entire program certification process and then recommending to ASE that your program be ASE CERTIFIED.

Briefly, the steps in the certification process are:

1. Purchase self-evaluation materials;
2. Conduct a self-evaluation using the Advisory Committee, staff, or a combination of the two;
3. Submit the self-evaluation for review by the National Automotive Technicians Education Foundation (NATEF) which directs the certification effort for ASE;
4. Arrange for and coordinate the outside team review of the areas approved for review by NATEF;
5. Receive notification and a plaque from ASE on the areas certified and publicize the certification to prospective students, employers, and the public.

The steps for conducting the self-evaluation are listed on the sheet entitled "Instructions for Self-Evaluation." Particular attention is directed to the first step which asks you to review the "Policies and Procedures Manual." This manual identifies the policies and standards established by the ASE Board for program certification.

#### INSTRUCTIONS FOR SELF-EVALUATION

1. Review the Policies and Procedures Manual with particular attention to the page entitled "Minimum Standards for Certification."
2. Select a person to coordinate the self-evaluation. This individual should be a supervisor or instructor from the institution.
3. Choose at least four other individuals in addition to the Coordinator for the self-evaluation. These persons should be from your program's Advisory Committee.
4. Divide the responsibilities for reviewing the items between members of your self-evaluation group. These items are listed in the Evaluation Guide Manual. The group may split into two subgroups and review different standards. Brief instructions for using the Evaluation Guide are given in the Introduction of the Evaluation Guide Manual.
5. Examine the program's operations and hold discussions with the staff and administration during the self-evaluation. Each individual must have an Evaluation Guide and mark his/her results on the rating sheets. The rating sheets may be used for Standards 1.1 - 10.3. The rating scale used to evaluate the items is (1)-poor through (5)-excellent.
6. After all reviews and observations are completed, the group determines average scores for each of the evaluation items. The coordinator averages the scores of each item by adding all of the numbers circled under each subsection and dividing by the number of items rated. The results are placed on the line beneath each standard.
7. The application, the rating sheets, and the list of recommended industry team members, are the first three documents to be forwarded to NATEF. Our address is:

NATEF  
13505 Dulles Technology Drive  
Herndon, Virginia 22071-3415

Upon receipt of these materials, NATEF will determine whether the program is ready for a team evaluation or whether it needs improvement. This information will be provided in a letter to your school's administrator and copies will be provided for you and your state supervisor.

POINTS TO NOTE: A program must certify in no less than three areas. The educational institution may be certified, therefore, in three to eight areas. The institution makes the choice of areas for certification, and certification in all eight areas is recognized by a "Master Certified" plaque.

Standard 1 under "Minimum Standards" identifies the minimum number of hours required in the course of study for each area. The hours required for one area cannot be compensated for by a number of hours above the minimum in another area. However, hours in both laboratory and directly-related instruction will be counted toward the minimum requirement.

As the self-evaluation is conducted, materials needed to document successful achievement of the points of evaluation should be prepared for the visiting team to review. The outside review team should not be required to dig through files for materials that were assembled for self-review.

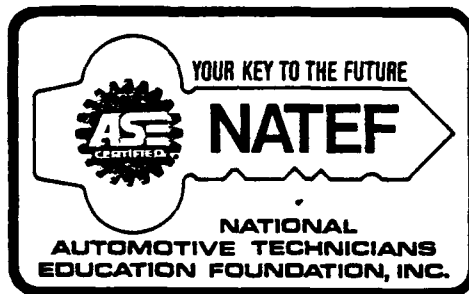
Please note that a list of proposed local persons from dealerships and independent service establishments must accompany the self-evaluation submitted to NATEF. The qualifications and numbers of such persons are listed in the "Policies and Procedures Manual." While it is permissible for half of the team to be educators with a background of recent instructional experience in automotive technician training, it is recommended that all team members, except the Evaluation Team Leader, be selected from service dealers in the geographical area served by the program.

After you have submitted your self-study and have been approved for team review, you will be notified of the name of the Evaluation Team Leader assigned to conduct the outside review of your program. It will be your responsibility to contact the person named and to arrange for the date and procedures for the team review. The Evaluation Team Leader (ETL) will be familiar with the process and will be of help in organizing the team review. A copy of your course of study is to be submitted to the ETL along with the application for team review.

If your self-study indicates that at least three areas are ready for team review, but others are not, you may still proceed with a team review of the approved areas. You may also elect to wait until the other areas are ready before proceeding with the on-site review.

A survey of certified schools has indicated the certification process has resulted in significant improvements in their program and greater recognition from students, employers, the public, and manufacturers who make donations. I hope that you will move boldly to prepare your program for ASE Certification.

**AUTOMOTIVE  
POLICIES AND PROCEDURES  
FOR NATEF  
TECHNICIAN TRAINING  
CERTIFICATION PROGRAM**



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## POLICIES FOR PROGRAM ORGANIZATION AND OPERATION

The Board of the National Institute for Automotive Service Excellence (ASE) will be the responsible body for the Automobile Technician Training Certification Program. ASE will grant certification to programs that comply with the evaluation procedure, meet established standards, and adhere to the policies in this document.

The Certification Program will be under the direct supervision of the Board of Trustees of the National Automotive Technicians Education Foundation (NATEF) and such personnel who are designated or employed by the Foundation. Personnel employed for the organization and operation of the Program will be paid from Foundation funds in accordance with provisions of the Foundation Charter.

The purpose of the Automobile Technician Training Certification Program is to improve technical instruction at the secondary and postsecondary levels, and private schools to prepare automobile technicians for employment. It is not intended to provide instruction to individuals, groups, or institutions.

The Program will be identified as a certification program and will not conflict with the accreditation role of other agencies.

The cost of the team evaluation will be as reasonable as possible to encourage program certification. A program's charges will include self-evaluation materials, team evaluation materials, honorarium, and expenses of the Evaluation Team Leader. During the initial period of development, the costs of national administration, and other costs approved by the Foundation Trustees, may be subsidized by the Foundation.

THE MINIMUM NUMBER OF AREAS A PROGRAM MAY PURSUE IS THREE.  
THE MAXIMUM NUMBER OF AREAS IS EIGHT.  
THE AREAS ARE AS FOLLOWS:

- Automatic Transmission/Transaxle
- Brakes
- Electrical Systems
- Engine Performance (including emission control systems)
- Engine Repair
- Heating and Air Conditioning
- Manual Drive Train and Axles
- Supension & Steering.

Once you have decided what areas you are pursuing, you need to return three items in order to begin the process. These three items are: 1. Application 2. Rating sheets completed by advisory committee 3. List of recommended team members to assist during on-site review.

Upon receipt of these items, we will send you notification of your program's status. You will either be approved for an on-site review, or be asked to make some improvements. This will be your first indication that we have received your packet. Therefore if you do not hear from us within one month of mailing your packet, please call as we may not have received it. If a program, or one area of a program does not meet the minimum requirements, the institution will be asked to make adjustments and to resubmit materials, or proceed with the areas that do qualify.

Once a program is approved, your State Director will identify an Evaluation Team Leader (ETL) for your program's on-site review. NATEF will notify you of the ETL assigned to your program. At this time, with a legitimate reason, you may contact the NATEF office and request another ETL. (The ETL assigned must NOT be a present or former teacher or administrator of the program to be evaluated.)

You are then asked to contact your ETL and arrange a date for the on-site evaluation. The ETL will do some coordinating with the team members but it is up to you to make sure they arrive on the day of the on-site and can stay until its completion. It is essential to have an alternate in case a team member is forced to cancel at the last minute. The evaluation team will consist of the ETL and two or three team members, for recertification or initial certification respectively. (Team members must not be members of the advisory committee or graduates of the program.)

An application for team evaluation must be sent to the ETL, signed by you, and accompanied by a check to cover the cost of materials for the team members. A copy of your course of study must be sent along with this application so that the ETL has a chance to review this before the evaluation day.

MINIMUM STANDARDS  
CERTIFICATION/RECERTIFICATION

1. A program providing instruction in all of the specialty areas must be no less than 1,080 laboratory or shop and instructional hours in length. Individual areas must be no less than the following hours in length:

a. Automatic Transmission/Transaxle	100
b. Brakes	80
c. Electrical Systems	200
d. Engine Performance	240
e. Engine Repair	120
f. Heating & Air Conditioning	100
g. Manual Drive Train and Axles	140
h. Suspension & Steering	100

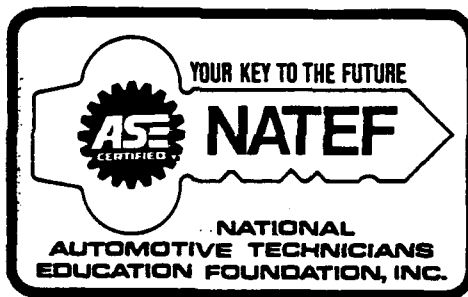
OR ALTERNATE: Any program not meeting this number of hours can meet the minimum qualifications by showing that seventy-five percent (75%) of the graduates successfully have passed ASE certification tests for the areas in which program certification is requested.

2. The average rating on Standards 6, 7, 8, and 9 shall be no less than four on a five-point scale.
3. Average ratings of less than four on a five-point scale on standards 1 through 5 and 10 may be cause for denying certification.
4. For initial CERTIFICATION the instructor must hold current ASE certification in the area(s) considered for certification.

OR ALTERNATE: The instructor must have a total of six years experience, with a minimum of three years as a practicing general automobile technician. The remaining years may be made up of either technician experience or post high school training.

5. For RECERTIFICATION the instructor must hold current ASE certification in the area(s) he/she is teaching. There is no alternate permitted for RECERTIFICATION.
6. An active Advisory Committee with a minimum of 5 people must be in place.
7. At least 80% of the High Priority (H.P.) items in the Task List must be included in the curriculum.

**AUTOMOTIVE  
PROGRAM STANDARDS  
FOR NATEF  
TECHNICIAN TRAINING  
CERTIFICATION PROGRAM**



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Herndon, VA 22071-3415

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## PROGRAM STANDARDS

### STANDARD 1 - PURPOSE

THE AUTOMOBILE TECHNICIAN TRAINING PROGRAM MUST HAVE CLEARLY STATED PROGRAM GOALS, RELATED TO THE NEEDS OF THE STUDENTS AND EMPLOYERS SERVED.

#### 1.1 EMPLOYMENT POTENTIAL

The employment potential for automobile technicians, trained to the level and for the specialty or generalist areas outlined in the program goals should exist in the geographic area served by the program.

#### 1.2 PROGRAM DESCRIPTION/GOALS

The written description/goals of the program must be shared with the potential student and must include admission requirements, employment potential, area(s) of specialty training offered, and the cost of all tuition and fees. Technical qualifications of the faculty and the overall goal(s) of the program should also be included.

### STANDARD 2 - ADMINISTRATION

PROGRAM ADMINISTRATION MUST INSURE THAT INSTRUCTIONAL ACTIVITIES SUPPORT AND PROMOTE THE GOALS OF THE PROGRAM.

#### 2.1 STUDENT COMPETENCY CERTIFICATION

The certificate or diploma a student receives upon program completion must clearly specify the area(s) the program is certified in and demonstrated competency in. These area(s) can be listed on a separate sheet of paper but the certificate must say "ASE Certified Program".

#### 2.2 CHAIN OF COMMAND

A line and staff structure should be used, indicating responsibilities for instruction, administration, and support services.

#### 2.3 ADMINISTRATIVE SUPPORT

Positive administrative support from institutional and local governing bodies must be demonstrated. (Support for staff in-service training and provision of appropriate facilities, up-to-date tools, equipment and training support materials would be appropriate indicators.)

#### 2.4 WRITTEN POLICIES

Written policies should be adopted by the administration and policy board for use in decision-making situations, and to provide guidance in achieving the program goals. Policies regarding safety, liability and shop operation should be written and prominently displayed, and provided to all students and instructors.

#### 2.5 ADVISORY COMMITTEE

An Advisory Committee must convene at least annually and be utilized to provide counsel, assistance, and information from the community served by the training program; this committee must be broadly based, and include former students, an employed technician, employers, and representatives of consumer's interest.

#### 2.6 PUBLIC/COMMUNITY RELATIONS

An organized plan may be used to provide the community at large information regarding the training program, its graduates, its plans, and any services provided to the community.

#### 2.7 LIVE WORK ACCOUNTING

A systematic method of collecting, accounting for, and disbursing live work repair receipts must be used. Instructional staff should not be required to collect payment for live work repairs.

### STANDARD 3 - LEARNING RESOURCES

SUPPORT MATERIAL CONSISTENT WITH BOTH PROGRAM GOALS AND PERFORMANCE OBJECTIVES MUST BE AVAILABLE TO STAFF AND STUDENTS.

#### 3.1 SERVICE MANUALS

Manuals with current manufacturers' service procedures and specifications for vehicles manufactured within the last ten (10) years must be available. These manuals must be located where students can use them while working in the shop area.

#### 3.2 MULTI-MEDIA

Appropriate up-to-date multi-media materials such as flip charts, tape slides, motion pictures, overhead transparency and video projection media should be decentralized and readily available wherever possible and utilized in the training process.

#### 3.3 INSTRUCTIONAL DEVELOPMENT SERVICES

The service of professional instructional development personnel should be used when available. At a minimum, equipment and supplies should be available for duplication of printed material and overhead projector transparency development. Instructional development personnel should conduct in-service and/or training in curriculum and media development on a structured basis.

#### 3.4 PERIODICALS

Current general and technical automotive magazines and newspapers must be available for student and instructor use.

#### 3.5 STUDENT MATERIALS

Necessary instructional texts or pertinent material must be available for each student to satisfy the objectives of the mode of instruction used. Where textbooks are used, specialized texts must carry a copyright date no older than 3 years and basic texts no older than 6 years.

#### STANDARD 4 - FINANCES

FUNDING MUST BE PROVIDED TO MEET THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

##### 4.1 PROGRAM ENROLLMENT

The enrollment in the program or program area should be sufficient to keep the per-student training costs to a realistic figure.

##### 4.2 BUDGET

An adequate annual budget must be developed, allocated and utilized for operation of the program.

##### 4.3 BUDGET PREPARATION

The budget should be prepared by the institutional administration in conjunction with the program faculty.

##### 4.4 STATUS REPORTS

Budget status reports should be made available to program staff, at least quarterly.

#### STANDARD 5 - STUDENT SERVICES

SYSTEMATIC PRE-ADMISSION TESTING, INTERVIEWS, COUNSELING SERVICES, AND PLACEMENT AND FOLLOW-UP PROCEDURES MUST BE USED.

##### 5.1 PRETESTING

A formal pretesting program should be (but not a requirement) used to assess a student's abilities in reading, mathematics, and manipulative skills to evaluate and assure the student a reasonable probability of success as an automobile technician. Testing procedures must be stated in program explanatory material and justification for all requirements must be available.

##### 5.2 PREADMISSION INTERVIEWS

Prior to program admission, a student must be interviewed and approved for admission.

##### 5.3 STUDENT RECORDS

Permanent records of former students of the program must be available preferably in one central location.

##### 5.4 PLACEMENT

A systematic student placement system must be used to assist program graduates to obtain employment in the automobile service industry.

##### 5.5 FOLLOW-UP

A follow-up system should be used to determine students' employment location and for feedback regarding the efficiency, effectiveness and appropriateness of training. The follow-up procedure should be designed to assure feedback regarding needed additions or deletions to the training curriculum, training program, and tool and equipment types compared to those found in industry. Follow-up of program graduates should indicate reasons for employment outside of the automotive service industry. When applicable, this information should be used to modify the training program quality and/or content.

#### 5.6 LEGAL REQUIREMENTS

The training program must meet all applicable local, state, and federal requirements.

#### STANDARD 6 - INSTRUCTION

INSTRUCTION MUST BE SYSTEMATIC AND REFLECT PROGRAM GOALS. A TASK LIST AND SPECIFIC PERFORMANCE OBJECTIVES WITH CRITERION REFERENCED MEASURES MUST BE USED.

##### 6.1 PROGRAM PLAN

The training plan must progress in logical steps, and provide for alternate sequences where applicable and be made available to each student.

##### 6.2 STUDENT TRAINING PLAN

A training plan for each student should be used, indicating the student's training goal(s) and specific steps needed to meet that goal. Each student should be given a copy of his/her training plan.

##### 6.3 PREPARATION TIME

Adequate time should be provided for teacher preparation and program development and/or modification.

##### 6.4 TEACHING LOAD

The instructor/student ratio and class contact hours should allow time for interaction on a one-to-one basis.

##### 6.5 CURRICULUM

- (a) At least 80% of the automobile diagnosis, service, and repair tasks designated "high priority" (H.P.) in the Task List (revised 1985) must be included in each certified area of automobile service instruction. Additional tasks may be added to meet the needs of local employers. All additional tasks must be approved by the program advisory committee.
- (b) The curriculum must provide training for three or more of the following areas: (1) Automatic Transmission/Transaxle, (2) Brakes, (3) Electrical Systems, (4) Engine Performance, (5) Engine Repair, (6) Heating and Air Conditioning, (7) Manual Drive Train and Axles, (8) Suspension and Steering.
- (c) Instruction on the legal aspects and responsibilities of the automobile technician in areas such as Environmental Protection Agency regulations, safety regulations, OSHA regulations, and other appropriate requirements must be included in the curriculum. Instruction and practice in filling out work order forms, ordering parts and basic record keeping must be a part of the training program.

##### 6.6 STUDENT PROGRESS

A record of each student's progress should be maintained through use of a progress chart or other recording device. The record should indicate tasks required for mastery in the area and those tasks the student has mastered.

#### 6.7 PERFORMANCE STANDARDS

All instruction must be performance based, with an acceptable performance standard stated for each task. These standards must be shared with students and potential employers. Students must demonstrate "hands-on competency" or "mastery" of a task before the instructor verifies student's performance.

#### 6.8 SAFETY STANDARDS

Safety instruction must be given prior to shop work and be an integral part of the training program. A safety test must be included in the training program. Eye protection must be worn in the shop area.

#### 6.9 PERSONAL CHARACTERISTICS

All training activities and instructional material must emphasize the importance of maintaining high personal characteristics.

#### 6.10 WORK HABITS/ETHICS

The training program must be organized in such a manner that work habits and ethical practices required on the job are an integral part of instruction.

#### 6.11 PROVISION FOR INDIVIDUAL DIFFERENCE

The training program should be structured in such a manner that students with different levels of cognitive and psychomotor skills can be accommodated.

#### 6.12 RELATED INSTRUCTION

Instruction in related mathematics, communication, and interpersonal relations should be provided and coordinated with ongoing instruction in the training program. This instruction shall be provided by a qualified Automotive instructor or by a qualified math or science instructor if the instruction is provided to a class of automotive students and applied to the automotive field.

#### 6.13 TESTING

Both written and performance based tests must be used to validate student competency. Students should be encouraged to take certification tests that are publicly recognized indicators of capabilities.

#### 6.14 EVALUATION OF INSTRUCTION

Instructional procedures must be evaluated in a systematic manner. This evaluation must be through regular reviews by students and the administration. Self-evaluation of instruction must also be utilized on a systematic and regular basis. The system must also include input from former students and advisory committee members. Instructional procedures must show a responsiveness to the feedback from these evaluations.

#### 6.15 LIVE WORK

Live work must be scheduled to benefit the student and supplement ongoing instruction. A student must have had instruction and practice on a specific repair task before live work requiring that task is assigned. Vehicles owned by students in the automobile technician training program and school buses or other vehicles owned or operated by the governing body or administrative personnel must not be the primary source of live work projects. All vehicles in the shop must have a completed industry-type work order attached to or in the vehicle.

#### 6.16 ARTICULATION

Agreements between programs with equivalent competencies should be used to eliminate unnecessary duplication of instruction.

### STANDARD 7 - EQUIPMENT

EQUIPMENT AND TOOLS USED IN THE AUTOMOBILE TECHNICIAN TRAINING PROGRAM MUST BE OF THE TYPE AND QUALITY FOUND IN THE REPAIR INDUSTRY AND MUST ALSO BE THE TYPE NEEDED TO PROVIDE TRAINING TO MEET THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

#### 7.1 SAFETY

Equipment and tools used in the training program must have all shields, guards, and other safety devices in place, operable and used.

#### 7.2 TYPE AND QUALITY

The tools and equipment used in the training program must reflect the program goals and performance objectives. Sufficient tools and equipment must be available on site for training offered. The tools and equipment must meet industry quality standards.

#### 7.3 CONSUMABLE SUPPLIES

Sufficient consumable supplies should be readily available to assure continuous instruction.

#### 7.4 MAINTENANCE

A preventative maintenance schedule should be used to minimize equipment down-time.

#### 7.5 REPLACEMENT

A systematic schedule for replacement should be used to maintain up-to-date tools and equipment at industry and safety standards. Student follow-up and advisory committee input should be used in this system.

#### 7.6 INVENTORY

An inventory system should be used to account for tools, equipment, parts, and supplies.

#### 7.7 PARTS PURCHASING

A systematic parts purchasing system -- from work order to parts man to jobber -- should be used. Task performance should not be unreasonably delayed due to a lack of replacement parts.

#### 7.3 HAND TOOLS

Each student must have a basic hand tool set comparable to tools required for employment. The students must be encouraged to purchase a hand tool set during the period of instruction, appropriate to the auto area(s) in which he/she is being trained. Adequate numbers of tools may be provided by tool boards or tool check-out procedures in place of separate tool boxes for each student.

#### STANDARD 8 - FACILITIES

THE PHYSICAL FACILITIES MUST BE ADEQUATE TO PERMIT ACHIEVEMENT OF THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

##### 8.1 TRAINING STATIONS

Training stations (bench and live work) must be available in the type and number required for the performance of tasks outlined in the program goals and performance objectives.

##### 8.2 SAFETY

The facilities must meet all applicable safety standards.

##### 8.3 MAINTENANCE

A regular facilities maintenance program should be used to assure facilities are suitable when required for instruction.

##### 8.4 HOUSEKEEPING

The classroom, shop, and support area(s) should be kept clean and orderly.

##### 8.5 OFFICE SPACE

An area separate from the shop must be available and convenient for the instructor(s) use as an office.

##### 8.6 INSTRUCTIONAL AREA

A classroom convenient to but separate from shop area must be available for instruction and other non-shop activities.

##### 8.7 STORAGE

Storage areas for tools, parts, supplies, and automobiles must be sufficient to support the activities outlined in the program goals and performance objectives. Security must be provided to prevent pilferage and vandalism.

##### 8.8 SUPPORT FACILITIES

Restrooms, clean up areas and lockers must be provided convenient to the instructional area.

##### 8.9 VENTILATION

An adequate exhaust fume removal system must be in place and operable. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning.

##### 8.10 FIRST AID

A first aid station must be in place and comply with local regulations.

#### 8.11 FACILITY EVALUATION

The Advisory Committee shall conduct an annual evaluation of the facilities to assure adequacy to meet program needs.

### STANDARD 9 - INSTRUCTIONAL STAFF

THE INSTRUCTIONAL STAFF MUST HAVE TECHNICAL COMPETENCY AND MEET ALL STATE AND LOCAL REQUIREMENTS FOR CERTIFICATION/CREDENTIALING.

#### 9.1 TECHNICAL COMPETENCY

The instructor must hold current ASE certification in the area considered for initial certification. OR ALTERNATE: The instructor must have a total of six years experience, with a minimum of three years as a practicing general automobile technician. The remaining years may be made up of either technician experience or post high school training. For RECERTIFICATION the instructor must hold current ASE certification in the area(s) he/she is teaching. There is no alternate permitted for RECERTIFICATION.

#### 9.2 INSTRUCTIONAL COMPETENCY/CERTIFICATION

Instructors must meet all state certifying requirements.

#### 9.3 TECHNICAL UPDATING

Faculty members must be provided technical materials required to maintain their competency. An opportunity must be provided for instructor(s) to return to industry on a regular basis for in-service and skill upgrading.

#### 9.4 FIRST AID

The instructor(s) should hold a current American National Red Cross Standard First Aid Certificate or the institution must provide a nurse who administers first aid services.

#### 9.5 SUBSTITUTES

A systematic method of obtaining "substitute" or "supply" instructors should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent automotive instructor.

### STANDARD 10 - COOPERATIVE AGREEMENTS

WRITTEN POLICIES AND PROCEDURES MUST BE USED FOR COOPERATIVE AND APPRENTICESHIP TRAINING PROGRAMS.

#### 10.1 STANDARDS

Student performance standards should be developed and coordinated by the supervising instructor.

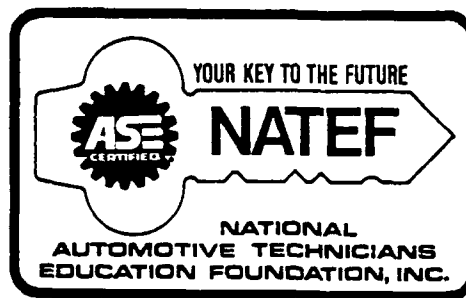
#### 10.2 AGREEMENTS

All agreements should be written and legally binding.

#### 10.3 SUPERVISION

A supervising automotive instructor must be assigned responsibility, authority and time to coordinate and monitor cooperative/apprenticeship automotive programs.

**AUTOMOTIVE  
EVALUATION GUIDE  
FOR NATEF  
TECHNICIAN TRAINING  
CERTIFICATION PROGRAM**



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## INTRODUCTION

This Evaluation Guide is used for the self-evaluation and the on-site team visit.

For the self-evaluation, you are to compare the items in this document with the Program Standards, and mark your results on the attached Rating Sheets. These items were developed to determine the degree the standards should be met.

The visiting team will review your program in four areas: your stated program goals, the overall program operation, area tasks included in your curriculum, and the program standards.

The team will be looking for discrepancies or mismatches between the items you have marked on your self-evaluation. You must be able to provide the team member with the appropriate material so he can review and verify the evaluation. Please have these materials readily available to guard against file searches and/or trips to other buildings. For example, if a safety test is routinely given to students, display a copy. If the item deals with employment (Standard 1.1), show statistics which give the percentage of graduates employed.

A list of tasks describing curriculum content, together with records or task performance must be available for the High Priority (H.P.) items in each area under review for certification. A course of study must also be present that describes how the tasks are incorporated into a plan of instruction and the time allotted for each area. This is critical in the certification decision. (See Standard 6.5.)

The following paragraph is another example of a procedure the visiting team will use on each standard to obtain a composite of the program:

The program may be seeking certification in the Automatic Transmission/Transaxle area. Item (7.2-A) asks the question, "Are the tools and equipment needed to provide training in each area to be certified available in the shop?" To answer a question such as this, you must look for evidence (the tools and equipment) and if you can not see them, ask the faculty to show you the appropriate material to verify the response. Each item must be assigned a rating of 1 (poor) to 5 (excellent) on the Supplementary Sheet-Report form. The evaluator must use his experience and careful observations when he assigns a rating. When more than one person is rating an item, the ratings will be averaged.

On items marked poor, it is essential that notes be made in order to justify your rating and to give help for program improvement. A low rating on a standard does not necessarily mean the program is deficient. The standards consist of elements which make up an ideal program. All programs will not have all elements. In your oral and written report, the seriousness of the discrepancy should be stated. This may or may not be the only response relative to areas in which the program is seeking certification. You must determine this by comparing the program goals and self-evaluation with the available evidence and make a decision.

## GLOSSARY OF TERMS

1. CURRICULUM: All the objectives, content, and learning activities arranged in a sequence for a particular instructional area. An orderly arrangement of integrated subjects, activities, time allocations, and experiences which students pursue for the attainment of a specific education goal.
2. COMPETENCY: (Hands On) - Performance of a task to the level or degree specified in the performance standard for the task.
3. CRITERION REFERENCED MEASURE(S): An exercise based on a performance objective for a task, and designed to measure attainment of that objective. (Also called performance test(s) or criterion referenced test.)
4. GOAL: A statement of the intended outcome of participation in the training program.
5. LIVE WORK: The processing, assignment and student performance of the appropriate diagnosis, rebuild or replacement tasks on street legal vehicles.
6. MASTERY: (See Competency - Hands On)
7. OBJECTIVE, PERFORMANCE: A written statement describing an intended outcome (competent task performance) in terms of student performance. (Also called "behavioral" objective or instructional objective) R.F. Mager Associates, 13245 Rhoda Drive, Los Altos Hill, California.
8. PERSONAL CHARACTERISTIC: Attributes which are not readily measurable, and are generally in the affective or cognitive domains.
9. AREA(S): Relates to one or more of the following eight areas: (1) Automatic Transmission/Transaxle, (2) Brakes, (3) Electrical Systems, (4) Engine Performance (including emission control systems) (5) Engine Repair, (6) Heating and Air Conditioning, (7) Manual Drive Train and Axles, and (8) Suspension and Steering.
10. STANDARD: "...Something established for use as a rule or basis of comparison in measuring quantity, quality, value, etc..." Webster's New World Dictionary (1973)
11. STANDARD PERFORMANCE: A written specification of the results of acceptable task performance.
12. STANDARD, PERSONAL: An attribute or characteristic of an individual which facilitates entry into and advancement in an occupation.

13. STANDARD, PROGRAM: A specific quality or desired characteristic or a training program designed to prepare individuals for employment.
14. TASK: A task (statement) describes a unit of work activity which has an identifiable beginning and ending point in its accomplishment, and consists of two or more observable steps.
15. TRAINING STATION: An area with appropriate tools and equipment, large enough to allow safety and competency development in task performance.

\*\*\*\*\*

Must or shall is an imperative need, duty or requirement; an essential or indispensable item; mandatory.

Should is used to express a recommendation, not mandatory but attainment would increase program quality.

May or could expresses freedom to follow a suggested alternative.

## EVALUATION GUIDE

### STANDARD 1 - PURPOSE

THE AUTOMOBILE TECHNICIAN TRAINING PROGRAM MUST HAVE CLEARLY STATED PROGRAM GOALS, RELATED TO THE NEEDS OF THE STUDENTS AND EMPLOYERS SERVED.

#### 1.1 EMPLOYMENT POTENTIAL

- A. What percentage of the program completers obtain employment in the automotive service industry within ninety days of program completion?
- B. Are employers surveyed on a regular basis (at least annually) to determine training needs of their potential employees?

#### 1.2 PROGRAM DESCRIPTION/GOALS

- A. Is a document available (brochure or catalog) which includes the following:
  - 1. Admission requirements?
  - 2. Employment potential?
  - 3. Area(s) of specialty training offered?
  - 4. Cost of tuition and fees?
  - 5. Technical qualifications of the instructional staff?
  - 6. Overall goal(s) of the program?
- B. Is the material given to students prior to enrollment?

### STANDARD 2 - ADMINISTRATION

PROGRAM ADMINISTRATION MUST INSURE THAT INSTRUCTIONAL ACTIVITIES SUPPORT AND PROMOTE THE GOALS OF THE PROGRAM.

#### 2.1 STUDENT COMPETENCY CERTIFICATION

Does the certificate or diploma a student receives upon program completion clearly specify the area(s) of demonstrated competency?

#### 2.2 CHAIN OF COMMAND

Does the administrative structure outline indicate the responsibilities and authorities of program personnel?

### 2.3 ADMINISTRATIVE SUPPORT

- A. Are provisions made for instructors to return to industry for planned in-service and beneficial upgrading on a regular basis?
- B. Are training stations available in the type and number required for specialty areas described in the program goals?
- C. Are the tools and equipment needed to provide the training described in the program goals and performance objectives available in the shop area?
- D. Do the tools and equipment exist in the quantity needed for efficient and effective instruction?
- E. Do the tools and equipment used in the training program meet industry quality standards?
- F. Are current general and technical automotive magazines and papers available for student and instructor use?
- G. Is the annual budget prepared by the program faculty in conjunction with the institutional administration?

If 1 or 2 is indicated on any of the above this indicates a lack of administrative support, please make notes of reasons for low ratings.

### 2.4 WRITTEN POLICIES

- A. Have written policies regarding student and institutional responsibilities been approved by the administrative and/or policy board?
- B. Are policies regarding safety, liability and shop operation prominently displayed in the shop area?
- C. Are these policies provided to each student and instructor?

### 2.5 ADVISORY COMMITTEE (A minimum of 5 required)

- A. Does the Advisory Committee meet two or more times a year? (Minutes of a meeting in the last six months must be available.)
- B. Do the minutes of the meetings indicate meaningful input by committee members?
- C. Is there at least one employed automobile technician on the committee?
- D. Are local employers adequately represented?
- E. Are consumer interests adequately represented?
- F. Are former students represented?

## 2.6 PUBLIC/COMMUNITY RELATIONS

Are public relations materials distributed on a regular basis?

## 2.7 LIVE WORK ACCOUNTING

- A. Is a system used to collect, account for and disburse live work repair receipts?
- B. Is support staff (not the instructors) responsible for collecting payment for live work repairs?

## STANDARD 3 - LEARNING RESOURCES

SUPPORT MATERIAL CONSISTENT WITH BOTH PROGRAM GOALS AND PERFORMANCE OBJECTIVES MUST BE AVAILABLE TO STAFF AND STUDENTS.

### 3.1 SERVICE MANUALS

- A. Are manuals with the major manufacturers' service procedures and specifications for vehicles manufactured within the last ten (10) years available for reference purposes?
- B. Are manufacturers' specification manuals located in the shop area?

### 3.2 MULTI-MEDIA

- A. Are appropriate, up-to-date multi-media materials and hardware such as flip charts, tape slides, motion and overhead transparency projectors, video equipment and other media used in the training process?
- B. Are media soft and hardware decentralized and readily available where appropriate?

### 3.3 INSTRUCTIONAL DEVELOPMENT SERVICES

- A. Do specialists provide media development services for the instructional staff?
- B. Are equipment and supplies available for faculty use in duplicating materials and producing overhead transparency materials or other media software?
- C. If curriculum or instructional development specialist(s) are employed by the school, do they hold regular in-service and/or training for curriculum and media development and equipment use?

### 3.4 PERIODICALS

Are current general and technical automotive magazines and newspapers available for student and instructor use?

### 3.5 STUDENT MATERIALS

- A. Are instructional texts or pertinent material available for each student which satisfy the objectives of the mode of instruction used?
- B. Are the specialty textbooks copyright dates no more than three (3) years old?
- C. Are the basic textbooks copyright dates no more than six (6) years old?

### STANDARD 4 - FINANCES

FUNDING MUST BE PROVIDED TO MEET THE APPROVED PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

#### 4.1 PROGRAM TRAINING COST

Is the per student training cost reasonable in terms of instructional goals?

#### 4.2 BUDGET

- A. Is an annual budget developed for program operation?
- B. Are the budgeted funds allocated to and used by the program?
- C. Is the funding adequate for program operation?

#### 4.3 BUDGET PREPARATION

Is the annual budget prepared by the institutional administration in conjunction with the program staff?

#### 4.4 STATUS REPORTS

Are budget status reports provided to instructional staff?

### STANDARD 5 - STUDENT SERVICES

SYSTEMATIC PRE-ADMISSION TESTING, INTERVIEWS, COUNSELING SERVICES AND PLACEMENT AND FOLLOW-UP PROCEDURES MUST BE USED.

#### 5.1 PRETESTING

- A. Are students pretested in the following areas prior to program enrollment?
  - 1. Reading
  - 2. Mathematics and Science
  - 3. Manipulative ability

B. Are testing procedures stated in the program explanatory material and available to all interested parties?

C. Is written justification available for all requirements?

#### 5.2 PRE-ADMISSION INTERVIEWS

Are students interviewed and approved prior to program admission?

#### 5.3 STUDENT RECORDS

Are the permanent records for former students in the program available in one central location?

#### 5.4 PLACEMENT

Is a systematic student placement system used to assist program graduates to obtain employment in the automobile service industry?

#### 5.5 FOLLOW-UP

A. Is a formal follow-up system used to determine student's employment location?

B. Does the follow-up questionnaire ask the students to rate the efficiency and effectiveness of their training?

C. Does the following procedure assure feedback regarding needed additions or deletions to the training curriculum, training program, and tool and equipment types compared to those the graduates are now using in industry?

D. Does the follow-up system for program graduates ask for reasons for employment outside of the automotive service industry?

E. Is this information used to modify the training program (if applicable)?

#### 5.6 LEGAL REQUIREMENTS

Is the training program in compliance with applicable local, state and federal education requirements?

### STANDARD 6 - INSTRUCTION

INSTRUCTION MUST BE SYSTEMATIC AND REFLECT PROGRAM GOALS. A TASK LIST AND SPECIFIC PERFORMANCE OBJECTIVES WITH CRITERION REFERENCED MEASURES MUST BE USED.

#### 6.1 PROGRAM PLAN

A. Is the training program logically sequenced?

B. Are alternate but equivalent paths available?

## 6.2 STUDENT TRAINING PLAN

- A. Is a specific training plan which indicates the student goals and the steps needed to meet that goal used for each student?
- B. Is each student given a copy of his/her training plan?

## 6.3 PREPARATION TIME

Does the instructor's daily schedule provide adequate time for planning?

## 6.4 TEACHING LOAD

- A. Is the current instructor/student ratio educationally sound?
- B. Has the average instructor/student ratio for the past year been educationally sound?
- C. What is the total number of student contact hours in the program or automotive area?

## 6.5 CURRICULUM

- A. Which of the following areas provide theory and "hands-on" training for 80% of the tasks designated "high priority" (H.P.) in the task list? Are the necessary tools and equipment available?

<u>AREA(S)</u>	<u>TOOLS &amp; EQUIPMENT</u> (Rate 1-5, each area)	<u>TASKS</u> (Percentage achieved)
1. Automatic Trans/Transaxle 2. Brakes 3. Electrical Systems 5. Engine Performance 4. Engine Repair 6. Heating and Air Conditioning 7. Manual Drive Train and Axles 8. Suspension & Steering		

- B. Have additional tasks been reviewed and approved by the program advisory committee?
- C. Does the curriculum include instruction on:
  - 1. OSHA regulations the student may encounter upon employment?
  - 2. Legal responsibilities of the technician regarding Environmental Protection Agency regulations?
  - 3. Other appropriate requirements which may affect their on-the-job activities?
- D. Are tasks requiring competency in filling out work order forms, ordering parts, and recording the time spent on a task included in the curriculum?

#### 6.6 STUDENT PROGRESS

Is a progress chart or other record keeping tool (with specific tasks) used to indicate student progress?

#### 6.7 PERFORMANCE STANDARDS

- A. Is an acceptable level of performance stated for each task?
- B. Are the standards given to students and potential employers?
- C. Are students required to demonstrate "hands-on competency" or "mastery" of a task before the instructor verifies a student's performance?

#### 6.8 SAFETY STANDARDS

- A. Is safety instruction given prior to shop work?
- B. Is safety instruction an integral part of the training program?
- C. Are regular safety tests included in the training program?
- D. Is eye protection worn in the shop area?

#### 6.9 PERSONAL STANDARDS

- A. Does all training activity and instructional material emphasize the following?
  - 1. The importance of maintaining good relationships with fellow employees?
  - 2. Respect for fellow students' tools and other property?
  - 3. The development of good customer relations?
  - 4. Appropriate clothes, similar to that found in local shops?
  - 5. Student cleanliness so seats, steering wheels, etc., are not greasy after the job is complete?
  - 6. The use of fender covers?

#### 6.10 WORK HABITS/ETHICS

- A. Is the training program organized in such a manner that work habits developed in the training program are similar to work habits required on the job?
- B. Is instruction in ethical practices an integral part of the program?

#### 6.11 PROVISIONS FOR INDIVIDUAL DIFFERENCE

Is the training program structured to accommodate students with different levels of cognitive and psychomotor ability?

#### 6.12 RELATED INSTRUCTION

- A. Is related mathematics, science, communications and interpersonal relations instruction coordinated with ongoing instruction in the training program?
- B. Is this instruction provided by a qualified instructor?

#### 6.13 TESTING

- A. Are written tests used to evaluate task performance?
- B. Are performance tests used to evaluate task performance?
- C. Do the performance tests have a stated go-no-go level of performance?
- D. Are students encouraged to take certification tests that are publicly recognized indicators of capabilities?

#### 6.14 EVALUATION OF INSTRUCTION

- A. Is a systematic program evaluation system used to make decisions about program efficiency, effectiveness and content?
- B. Is student input used in the evaluation system?
- C. Are instructor(s) evaluations used in the evaluation system?
- D. Is self evaluation of instruction utilized on a regular basis?
- E. Is student follow-up data reviewed and systematically used in the evaluation process?
- F. Does the advisory committee review the task list for additions or deletions?

#### 6.15 LIVE WORK

- A. Does evidence exist that all live work benefits the student and supplements ongoing instruction?
- B. Has a student had instruction and practice on a specific repair task before a live work job requiring this task is assigned?

C. Do the program policies EXCLUDE the following vehicles as the PRIMARY source of live work projects?

1. Vehicles owned by students in the automobile/technician training program?
2. School buses or other vehicles owned and operated by the governing body or administrative personnel?

D. Do all vehicles in the shop have an industry type work order written up and then attached to or placed inside the vehicle?

#### 6.16 ARTICULATION

Are agreements used between programs with equivalent competencies to eliminate unnecessary duplication of instruction?

### STANDARD 7 - EQUIPMENT

EQUIPMENT AND TOOLS USED IN THE AUTOMOBILE TECHNICIAN TRAINING PROGRAM MUST BE OF THE TYPE AND QUALITY FOUND IN THE REPAIR INDUSTRY AND MUST ALSO BE THE TYPE NEEDED TO PROVIDE TRAINING TO MEET THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

#### 7.1 SAFETY

Are all shields, guards, and other safety devices in place, operable and used?

#### 7.2 TYPE AND QUANTITY

- A. Are the tools and equipment needed to provide training in each area to be certified available in the shop area?
- B. Do the tools and equipment exist in the quantity needed for efficient and effective instruction?
- C. Do the tools and equipment used in the training program meet industry quality standards?

#### 7.3 CONSUMABLE SUPPLIES

Are sufficient consumable supplies readily available to assure continuous instruction?

#### 7.4 MAINTENANCE

Is a preventative maintenance program used to minimize equipment down-time?

#### 7.5 REPLACEMENT

- A. Is a systematic replacement schedule used to maintain up-to-date tools and equipment at industry and safety standards?
- B. Is student follow-up and local Advisory Committee input used in the replacement system?

#### 7.6 INVENTORY

Is an inventory system used to account for tools, equipment, parts and supplies?

#### 7.7 PARTS PURCHASING

- A. Is a systematic parts purchasing system used -- from work order to parts man to jobber?
- B. Does the lack of parts delay task performance?

#### 7.8 HAND TOOLS

- A. Does each student have a basic hand tool set comparable to the tools that will be required for employment or are there sufficient tools available in an efficient pattern of distribution so that instruction and work are not hindered.
- B. Is each student encouraged to purchase a hand tool set (during the period of instruction) which is appropriate to the automotive specialty area(s) in which he/she is being trained?

### STANDARD 8 - FACILITIES

THE PHYSICAL FACILITIES MUST BE ADEQUATE TO PERMIT ACHIEVEMENT OF THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

#### 8.1 TRAINING STATIONS

Are training stations available in the type and number required for task performance as outlined in the program goals and performance objectives?

- A. Adequate bench space?
- B. Adequate shop space?

#### 8.2 SAFETY

- A. Are hazardous areas (brake shoe grinding, welding, etc.) identified with signs?
- B. Do fire extinguishers have regular, current inspection tags attached and meet fire codes for different types of fires?

- C. Is an electrical disconnect system available to shut down all outlets in case of an emergency?
- D. Is lighting adequate for task performance and safety?
- E. Are regular safety inspections held?
- F. Are all other applicable safety standards met?
- G. Are vehicle traffic areas identified?

### 8.3 MAINTENANCE

Is a regular facilities maintenance program used to insure facilities suitable for instruction?

### 8.4 HOUSEKEEPING

- A. Is the classroom and shop area clean and orderly?
- B. Are the parking and storage areas clean and orderly?

### 8.5 OFFICE SPACE

Is an area separate from the shop available and convenient for the instructor(s) use as an office?

### 8.6 INSTRUCTIONAL AREA

Is an area convenient to but separate from the shop provided for theory instruction and other non-shop activities?

### 8.7 STORAGE

- A. Is the storage area for specialized tools adequate to support the activities outlined in the program goals and performance objectives?
- B. Is the storage area for parts and supplies adequate to support the activities outlined in the program goals and performance objectives?
- C. Is the storage area for automobiles adequate to support the activities outlined in the program goals and performance objectives?
- D. Is a storage area provided for student tool boxes?
- E. Are the storage areas secure from pilferage and vandalism?

### 8.8 SUPPORT FACILITIES

- A. Is an area convenient to the training area provided for students to clean up after shop activities?
- B. Are lockers conveniently located?

C. Are restrooms conveniently located?

8.9 VENTILATION

A. Is an exhaust fume removal system in place and operable?

B. Do heating and cooling systems provide sufficient comfort for learning?

8.10 FIRST AID

A. Is a first aid station available to the program?

B. Is it well marked?

C. Is it equipped with basic, up-to-date first aid supplies?

8.11 FACILITY EVALUATION

Does the Advisory Committee conduct an annual evaluation of the facilities to assure adequacy to meet program needs?

STANDARD 9 - INSTRUCTIONAL STAFF

THE INSTRUCTIONAL STAFF MUST HAVE TECHNICAL COMPETENCY AND MEET ALL STATE AND LOCAL REQUIREMENTS FOR CERTIFICATION/CREDENTIALING.

9.1 TECHNICAL COMPETENCY (Rate each instructor in the program.)

A. How many years work experience as a general automobile technician?

B. How many years work experience as an automobile technician in the specialty taught?

C. Do instructors hold current National Institute for Automotive Service Excellence certification in the area(s) they instruct?

D. How many years of education beyond high school have been completed by the instructor?

9.2 INSTRUCTIONAL COMPETENCY/CERTIFICATION

Do the instructors meet all state certifying requirements?

9.3 TECHNICAL UPDATING

A. Are automotive trade publications, service bulletins, and other materials needed to maintain technical competency provided to the instructional staff?

B. Are opportunities provided for instructors to return to industry for planned in-service and beneficial skill upgrading on a regular basis?

#### 9.4 FIRST AID

Do all automotive instructors hold a current American National Red Cross Standard First Aid Certificate or does the institution provide a nurse who administers first aid services?

#### 9.5 SUBSTITUTE

- A. Is a systematic method used to obtain "substitute" or "supply" instructors?
- B. Is an orientation session for substitutes held on a regular basis?
- C. Are the substitutes competent in automotive instruction?

### STANDARD 10 - COOPERATIVE AGREEMENTS

WRITTEN POLICIES AND PROCEDURES MUST BE USED FOR COOPERATIVE AND APPRENTICESHIP TRAINING PROGRAMS.

#### 10.1 STANDARDS

Are the performance standards a student will be expected to meet developed and coordinated by the supervising instructor?

#### 10.2 AGREEMENTS

Are all agreements between the institution and the work location written and legally binding?

#### 10.3 SUPERVISION

Is a supervising automotive instructor assigned the responsibility, authority, and time to coordinate and monitor cooperative automotive programs?

## ASSUMPTIONS

1. It is assumed:

- that in all areas, appropriate theory, safety and support instruction will be required for performing each task
- that this instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks
- that the student has received the necessary training to locate and use current reference and training materials from accepted industry publications

2. It is assumed:

- that all diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturer's recommended procedures as published

3. It is assumed:

- that individual training programs being evaluated for certification should have written and detailed performance standards for each task covered and taught in the curriculum
- that learning progress of students will be monitored and evaluated against these performance standards
- that a system is in place which informs all students of their individual progress through all phases of the training program

4. It is assumed:

- that individual courses of study will differ across automobile technician training programs
- that development of appropriated learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program

5. It is assumed:

- that all students will receive instruction in the storage, handling, and use of Hazardous Materials in accordance with Hazard Communication "Title 21 Code of Federal Regulation Part 1910.1200", "Right to Know Law"

# EVALUATION GUIDE RATING SHEET

## STANDARD 1 - PURPOSE

Average Evaluation \_\_\_\_\_

### 1.1 Employment Potential

A. \_\_\_\_\_  
B. 1 2 3 4 5

### 1.2 Program Description/Goals

A1. 1 2 3 4 5  
A2. 1 2 3 4 5  
A3. 1 2 3 4 5  
A4. 1 2 3 4 5  
A5. 1 2 3 4 5  
A6. 1 2 3 4 5  
B. 1 2 3 4 5

## STANDARD 2 - ADMINISTRATION

Services

Average Evaluation \_\_\_\_\_

### 2.1 Student Competency Certification

1 2 3 4 5

### 2.2 Chain of Command

1 2 3 4 5

### 2.3 Administrative Support

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5  
D. 1 2 3 4 5  
E. 1 2 3 4 5  
F. 1 2 3 4 5  
G. 1 2 3 4 5

### 2.4 Written Policies

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5

### 2.5 Advisory Committee

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5  
D. 1 2 3 4 5  
E. 1 2 3 4 5  
F. 1 2 3 4 5

### 2.6 Public/Community Relations

1 2 3 4 5

### 2.7 Live Work Accounting

A. 1 2 3 4 5  
B. 1 2 3 4 5

## STANDARD 3 - LEARNING RESOURCES

Average Evaluation \_\_\_\_\_

### 3.1 Service Manuals

A. 1 2 3 4 5  
B. 1 2 3 4 5

### 3.2 Multi-media

A. 1 2 3 4 5  
B. 1 2 3 4 5

### 3.3 Instructional Development

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5

### 3.4 Periodicals

1 2 3 4 5

### 3.5 Student Materials

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5

## STANDARD 4 - FINANCES

Average Evaluation \_\_\_\_\_

### 4.1 Program Training Cost

1 2 3 4 5

### 4.2 Budget

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5

### 4.3 Budget Preparation

1 2 3 4 5

### 4.4 Status Reports

1 2 3 4 5

# STANDARD 5 - STUDENT SERVICES

## Average Evaluation

### 5.1 Pretesting

A1.	1	2	3	4	5
A2.	1	2	3	4	5
A3.	1	2	3	4	5
B.	1	2	3	4	5
C.	1	2	3	4	5

### 5.2 Preadmission Interviews

YES NO

### 5.3 Student Records

1 2 3 4 5

### 5.4 Placement

1 2 3 4 5

### 5.5 Follow-up

A.	1	2	3	4	5
B.	1	2	3	4	5
C.	1	2	3	4	5
D.	1	2	3	4	5
E.	1	2	3	4	5

### 5.6 Legal Requirements

1 2 3 4 5

# STANDARD 6 - INSTRUCTION

## Average Evaluation

### 6.1 Program Plan

A.	1	2	3	4	5
B.	1	2	3	4	5

### 6.2 Student Training Plan

A.	1	2	3	4	5
B.	1	2	3	4	5

### 6.3 Preparation Time

1 2 3 4 5

### 6.4 Teaching Load

A.	1	2	3	4	5
B.	1	2	3	4	5
C.					

### 6.5 Curriculum

#### Tools & Equipment

A1.	1	2	3	4	5
A2.	1	2	3	4	5
A3.	1	2	3	4	5
A4.	1	2	3	4	5
A5.	1	2	3	4	5
A6.	1	2	3	4	5
A7.	1	2	3	4	5
A8.	1	2	3	4	5
B.	1	2	3	4	5
C1.	1	2	3	4	5
C2.	1	2	3	4	5
C3.	1	2	3	4	5
D.	1	2	3	4	5

#### Tasks

	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

### 6.6 Student Progress

1 2 3 4 5

### 6.7 Performance Standards

A.	1	2	3	4	5
B.	1	2	3	4	5
C.	1	2	3	4	5

### 6.8 Safety Standards

A.	1	2	3	4	5
B.	1	2	3	4	5
C.	1	2	3	4	5
D.	1	2	3	4	5

### 6.9 Personal Standards

A1.	1	2	3	4	5
A2.	1	2	3	4	5
A3.	1	2	3	4	5
A4.	1	2	3	4	5
A5.	1	2	3	4	5
A6.	1	2	3	4	5

### 6.10 Work Habits/Ethics

A.	1	2	3	4	5
B.	1	2	3	4	5

### 6.11 Provisions for Individual Difference

1 2 3 4 5

### 6.12 Related Instruction

A.	1	2	3	4	5
B.	1	2	3	4	5

6.13 Testing

A. 1	2	3	4	5
B. 1	2	3	4	5
C. 1	2	3	4	5
D. 1	2	3	4	5

6.14 Evaluation of Instruction

A. 1	2	3	4	5
B. 1	2	3	4	5
C. 1	2	3	4	5
D. 1	2	3	4	5
E. 1	2	3	4	5
F. 1	2	3	4	5

6.15 Live Work

A. 1	2	3	4	5
B. 1	2	3	4	5
C. 1)1	2	3	4	5
C. 2)1	2	3	4	5
D. 1	2	3	4	5

6.16 Articulation

1	2	3	4	5
---	---	---	---	---

STANDARD 7 - EQUIPMENT

Average Evaluation

7.1 Safety

1	2	3	4	5
---	---	---	---	---

7.2 Type and Quantity

A. 1	2	3	4	5
B. 1	2	3	4	5
C. 1	2	3	4	5

7.3 Consumable Supplies

1	2	3	4	5
---	---	---	---	---

7.4 Maintenance

1	2	3	4	5
---	---	---	---	---

7.5 Replacement

A. 1	2	3	4	5
B. 1	2	3	4	5

7.6 Inventory

1	2	3	4	5
---	---	---	---	---

7.7 Parts Purchasing

A. 1	2	3	4	5
B. 1	2	3	4	5

7.8 Hand Tools

A. 1	2	3	4	5
B. 1	2	3	4	5

STANDARD 8 - FACILITIES

Average Evaluation

8.1 Training Stations

A. 1	2	3	4	5
B. 1	2	3	4	5

8.2 Safety

A. 1	2	3	4	5
B. 1	2	3	4	5
C. 1	2	3	4	5
D. 1	2	3	4	5
E. 1	2	3	4	5
F. 1	2	3	4	5
G. 1	2	3	4	5

8.3 Maintenance

1	2	3	4	5
---	---	---	---	---

8.4 Housekeeping

A. 1	2	3	4	5
B. 1	2	3	4	5

8.5 Office Space

1	2	3	4	5
---	---	---	---	---

8.6 Instructional Area

1	2	3	4	5
---	---	---	---	---

8.7 Storage

A. 1	2	3	4	5
B. 1	2	3	4	5
C. 1	2	3	4	5
D. 1	2	3	4	5
E. 1	2	3	4	5

### 8.8 Support Facilities

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5

### 8.9 Ventilation

A. 1 2 3 4 5  
B. 1 2 3 4 5

### 8.10 First Aid

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5

### 8.11 Facility Evaluation

1 2 3 4 5

## STANDARD 10 - COOPERATIVE AGREEMENTS

Average Evaluation \_\_\_\_\_  
10.1 Standards

1 2 3 4 5

### 10.2 Agreements

1 2 3 4 5

### 10.3 Supervision

1 2 3 4 5

## STANDARD 9 - INSTRUCTIONAL STAFF

Average Evaluation \_\_\_\_\_  
9.1 Technical Competency

	Instructor 1	Instructor 2	Instructor 3	Instructor 4	Instructor 5
A.	_____	_____	_____	_____	_____
B.	_____	_____	_____	_____	_____
C.	YES NO	YES NO	YES NO	YES NO	YES NO
D.	_____	_____	_____	_____	_____

### 9.2 Instructional Competency/Certification

1 2 3 4 5

### 9.3 Technical Updating

A. 1 2 3 4 5  
B. 1 2 3 4 5

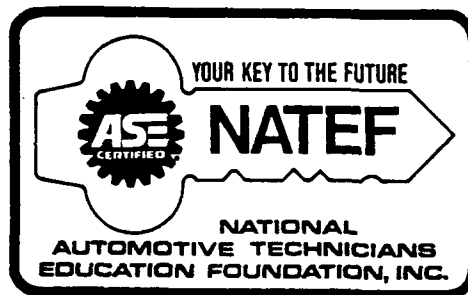
### 9.4 First Aid

1 2 3 4 5

### 9.5 Substitute

A. 1 2 3 4 5  
B. 1 2 3 4 5  
C. 1 2 3 4 5

**AUTOMOTIVE  
TASK LIST  
FOR NATEF  
TECHNICIAN TRAINING  
CERTIFICATION PROGRAM**



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## TASK LIST

An essential element of any curriculum or training program is a validated task list. Automobile technician instructors need a well-developed task list that serves as a solid base for course of study outlines. This also facilitates communication and articulation of training programs with other institutions in the region.

The task lists in this guide were validated for content accuracy and completeness using detailed job/task analysis approaches and methods. Groups of recognized content experts in each area of the automobile industry and vocational education nationwide, were called on to develop and validate these task lists. Validation was also achieved by surveying groups of working technicians, certified by the National Institute for Automotive Service Excellence (ASE), in each area covered by these tasks. This population was chosen to identify tasks performed by recognized competent automotive service personnel. Entry level personnel were not included in the survey.

A minimum of 30% of the tasks designated as high priority (HP) must be included in the instructional program to meet the NATEF certification standards. These judgements were reached by overwhelming consensus of the committees of content experts and ASE certified field technicians included in the validation survey.

Theory instruction and hands-on performance of all the basic tasks will provide initial training for employment in the automotive service field, or further training in any or all of the specialty areas. Competency in the HP tasks will indicate to employers that the graduate is skilled in that area.

### ASSUMPTIONS

1. It is assumed:

- that in all areas, appropriate theory, safety and support instruction will be required for performing each task;
- that this instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks;
- that the student has received the necessary training to locate and use current reference and training materials from accepted industry publications.

2. It is assumed:

- that all diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturer's recommended procedures as published.

3. It is assumed:

- that individual training programs being evaluated for certification should have written and detailed performance standards for each task covered and taught in the curriculum;
- that learning progress of students will be monitored and evaluated against these performance standards;
- that a system is in place which informs all students of their individual progress through all phases of the training program.

4. It is assumed:

- that individual courses of study will differ across automobile technician training programs;
- that development of appropriated learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program.

5. It is assumed:

- that all students will receive instruction in the storage, handling, and use of Hazardous Materials in accordance with Hazard Communication "Title 29 Code of Federal Regulation Part 1910.1200", "Right to Know Law".

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#### DEFINITIONS

ADD - To increase fluid or pressure to the correct level or amount.

ADJUST - To bring components to specified operational settings.

AIR TEST - To use air pressure to determine proper action of components.

ALIGN - To bring to precise alignment or relative position of components.

ANALYZE - To determine the relationship of components of an operation.

ASSEMBLE (REASSEMBLE) - To fit together the components of a device.

BALANCE - To establish correct linear, rotational, or weight relationship.

BLEED - To allow air or fluids to enter or exit a closed system.

CHARGE - To bring to "full" state; e.g., battery or air conditioning system.

CHECK - To verify condition by performing an operational or comparative examination.

CLEAN - To rid component of extraneous matter for the purpose of reconditioning, repairing, measuring, or reassembling.

DETERMINE - To establish the procedure to be used to effect the necessary repair.

DIAGNOSE - To locate the cause or nature of a problem by using the specified procedure.

DISASSEMBLE - To separate a component's parts as a preparation for cleaning, inspection, or service.

DISCHARGE - To empty a storage device or system.

DRAIN - To use gravity to empty a container.

EVACUATE - To remove air, fluid, or vapor from a closed system by use of a vacuum pump.

FILL (REFILL) - To bring fluid level to specified point or volume.

FIND - To locate a particular problem, e.g., shorts, grounds, or opens in an electrical circuit.

FLUSH - To use a fluid to clean an internal system.

HONE - To restore or resize or bore by using rotating cutting stones.

IDENTIFY - To establish the identity of a vehicle or component prior to service; to determine the nature or degree of a problem.

INSPECT - (SEE CHECK)

INSTALL (REINSTALL) - To place a component in its proper position in a system.

JUMP START - To use an auxiliary power supply, i.e., battery, battery charger, etc. to assist a car's battery to crank an engine.

LEAK TEST - To locate the source of leaks in a component or system.

LISTEN - To use audible clues in the diagnostic process; to hear the customer's description of a particular problem.

LUBRICATE - To employ the correct procedures and materials in performing the prescribed lubrication service.

MEASURE - To compare existing dimensions to specified dimensions by the use of calibrated instruments and gauges.

MOUNT - To attach or place tool or component in proper position.

PRESSURE TEST - To use air or fluid pressure to determine the condition or operation of a component or system.

PERFORM - To accomplish a procedure in accordance with established methods.

PURGE - To eliminate undesired air or fluid from a closed system.

READY - To prepare a system or component for service, installation, or operation.

REASSEMBLE - (SEE ASSEMBLE)

REFILL - (SEE FILL)

REINSTALL - (SEE INSTALL)

REMOVE - To disconnect and separate a component from a system.

REPAIR - To restore a malfunctioning component or system to operating condition.

REPLACE - To exchange an unserviceable component with a new or rebuilt component; to reinstall a component.

RESET (SET) - To adjust a variable component to a given, usually initial, specification.

SELECT - To choose the correct part or setting during assembly or adjustment.

SERVICE - To perform a specified procedure when called for in the owner's or service manual.

TEST - To verify condition through the use of meters, gauges, or instruments.

TRIM - (SEE ADJUST)

TORQUE - To tighten a fastener to specified degree or tightness (in a given order or pattern if multiple fasteners are involved on a single component).

VACUUM TEST - To determine the integrity and operation of a vacuum operated component and/or system.

VERIFY - To establish that a problem exists, after hearing the customer's complaint and performing a preliminary diagnosis.

## ENGINE REPAIR

## GENERAL ENGINE DIAGNOSIS; REMOVAL AND REINSTALLATION (R & R)

PRIORITY

- |     |   |    |
|-----|---|----|
| 1.  | Interpret complaint; and/or road test vehicle; determine needed repairs.  | HP |
| 2.  | Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed repairs.                                | HP |
| 3.  | Listen to engine noises; determine needed repairs.  | HP |
| 4.  | Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine needed repairs. | HP |
| 5.  | Perform engine vacuum tests; determine needed repairs.  | HP |
| 6.  | Perform cylinder power balance tests; determine needed repairs.   | HP |
| 7.  | Perform cylinder compression tests; determine needed repairs.   | HP |
| 8.  | Perform cylinder leakage tests, determine needed repairs.   | HP |
| 9.  | Remove engine (front wheel drive); prepare for tear down.   | HP |
| 10. | Reinstall engine (front wheel drive).   | HP |
| 11. | Remove engine (rear wheel drive); prepare for tear down.  | HP |
| 12. | Reinstall engine (rear wheel drive).  | HP |

## CYLINDER HEAD AND VALVE TRAIN DIAGNOSIS AND REPAIR

- |    |   |    |
|----|---|----|
| 1. | Remove cylinder heads; visually inspect cylinder heads for cracks; gasket surface areas for warpage and leakage; check passage condition. | HP |
| 2. | Install cylinder heads and gaskets.   | HP |
| 3. | Inspect and test valve springs for squareness, pressure, and free height comparison; replace as necessary.                                | HP |
| 4. | Inspect valve spring retainers, locks, and valve lock grooves.  | HP |

- |     |  |    |
|-----|--|----|
| 5.  | Replace valve stem seals.  | HP |
| 6.  | Inspect valve guides for wear, check valve guide height and stem-to-guide clearance; recondition/replace as necessary.   | HP |
| 7.  | Inspect valves; resurface or replace.  | HP |
| 8.  | Inspect valve seats; resurface or replace.   | HP |
| 9.  | Check valve face-to-seat contact and valve seat concentricity (runout); service seats and valves as necessary.   | HP |
| 10. | Check valve spring assembled height and valve stem height; service valve and spring assemblies as necessary.   | HP |
| 11. | Inspect pushrods, rocker arms, rocker arm pivots, and shafts for wear, bending, cracks, looseness, and blocked oil passages; repair or replace.                                    | HP |
| 12. | Inspect, test, and replace hydraulic or mechanical lifters.  | HP |
| 13. | Adjust valves (mechanical and hydraulic lifters).  | HP |
| 14. | Inspect and replace camshaft drives. (includes checking gear wear and backlash, sprocket and chain wear, overhead cam drive sprockets, drive belts, belt tension, and tensioners). | HP |
| 15. | Inspect and measure camshaft journals and lobes.   | HP |
| 16. | Inspect and measure camshaft bearing surfaces for damage, out-of-round, and alignment; determine needed repairs.   | HP |
| 17. | Measure camshaft timing.   | HP |

#### ENGINE BLOCK DIAGNOSIS AND REPAIR

- |    |   |    |
|----|---|----|
| 1. | Inspect and replace pans, covers, gaskets, and seals.   | HP |
| 2. | Visually inspect engine block for cracks, passage condition, core and gallery plug condition, and surface warpage; service block or determine needed repairs. | HP |

3. Inspect and repair damaged threads. HP
4. Remove cylinder wall ridges. HP
5. Inspect and measure cylinder walls for damage and wear; determine needed repairs. HP
6. Hone and clean cylinder walls. HP
7. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine needed repairs. HP
8. Inspect crankshaft for surface cracks and journal damage; check oil passage condition; measure journal wear; service crankshaft or determine needed repair. HP
9. Inspect and measure main and connecting rod bearings for damage, clearance, and end play; determine needed repairs (includes the proper selection of bearings). HP
10. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; inspect rod alignment and bearing bore condition. HP
11. Inspect, measure, service, or replace pistons. HP
12. Install new piston pins and bushings (as applicable).
13. Inspect, measure, and install piston rings. HP
14. Inspect, repair or replace crankshaft vibration damper (harmonic balancer). HP
15. Inspect crankshaft flange and flywheel/flexplate for burrs; HP repair as necessary.
16. Inspect flywheel/flexplate for cracks, wear (includes ring gear), and measure runout; determine needed repairs. HP
17. Inspect, remove and replace crankshaft pilot bearing/bushing (as applicable). HP
18. Reassemble engine parts using correct gaskets and sealants. HP
19. Inspect auxiliary (balance, intermediate, idler, counterbalance, or silencer) shaft(s); inspect shafts and support bearings for damage and wear; determine needed repairs; reinstall and time. HP

20. Prime engine lubrication system.

HP

LUBRICATION AND COOLING SYSTEMS DIAGNOSIS AND REPAIR

- |   |    |
|---|----|
| 1. Perform oil pressure tests; determine needed repairs.  | HP |
| 2. Inspect, measure, repair, or replace oil pumps (includes gears, rotors, and housing), pressure relief devices, and pump drives.                        | HP |
| 3. Perform cooling system tests (pressure, combustion leakage, and temperature); determine needed repairs.  | HP |
| 4. Inspect, replace, and adjust drive belts and pulleys.  | HP |
| 5. Inspect and replace engine cooling and heater system hoses.  | HP |
| 6. Inspect, test, and replace thermostat, by-pass, and housing.   | HP |
| 7. Inspect coolant; drain, flush, refill, and bleed cooling system with recommended coolant.  | HP |
| 8. Inspect, test, and replace water pump.   | HP |
| 9. Inspect, test, and replace radiator, pressure cap, and coolant recovery system.  | HP |
| 10. Clean, inspect, test, and replace fan(s) electrical and mechanical), fan clutch, fan shroud, and cooling system related temperature sensors/switches. | HP |
| 11. Inspect, test, repair or replace auxiliary oil coolers.   | HP |
| 12. Inspect, test, and replace oil temperature/pressure switches and sensors.   | HP |
| 13. Perform oil change. (Note: Special diesel/turbocharged engine procedures must be followed).   | HP |

## AUTOMATIC TRANSMISSION/TRANSAXLE

### GENERAL TRANSMISSION/TRANSAXLE DIAGNOSIS

### PRIORITY

- |    |   |    |
|----|---|----|
| 1. | Interpret driver's complaint; verify proper engine operation; determine needed repairs.           | HP |
| 2. | Diagnose transmission noise and vibration problems; determine needed repairs.                     |    |
| 3. | Diagnose unusual fluid usage, level, and condition problems; determine needed repairs.            | HP |
| 4. | Perform pressure tests; determine needed repairs.   | HP |
| 5. | Perform stall tests; determine needed repairs.  | HP |
| 6. | Perform lock-up converter system tests; determine needed repairs.                                 | HP |
| 7. | Diagnose electrical/electronic, mechanical, and vacuum control systems; determine needed repairs. | HP |

### TRANSMISSION/TRANSAXLE MAINTENANCE AND ADJUSTMENT

- |    |   |    |
|----|---|----|
| 1. | Inspect, adjust, or replace manual shift valve and throttle (TV) linkages/cables (as applicable). | HP |
| 2. | Adjust bands.   | HP |
| 3. | Service transmission; perform visual inspection; replace fluids and/or filters.                   | HP |
| 4. | Inspect, adjust, and replace electronic sensors, wires, and connectors; determine needed repairs. | HP |

### IN-VEHICLE TRANSMISSION/TRANSAXLE REPAIR

- |    |   |    |
|----|---|----|
| 1. | Inspect, adjust, and replace (as applicable) vacuum modulator; inspect and repair or replace lines and hoses. | HP |
| 2. | Inspect, repair, and replace governor cover, seals, sleeve, valve, weights, springs, retainers, and gear.     | HP |
| 3. | Inspect and replace external seals and gaskets.   | HP |
| 4. | Inspect, repair, and replace extension housing; replace bushing and seal.                                     | HP |

- |     |   |    |
|-----|---|----|
| 5.  | Inspect, leak test, flush, and replace cooler, lines and fittings.  | HP |
| 6.  | Measure cooler flow rate.   | HP |
| 7.  | Inspect and replace speedometer drive gear, driven gear, and retainers.   | HP |
| 8.  | Inspect, measure, repair, and replace valve body (includes surfaces and bores, springs, valves, sleeves, retainer, brackets, check balls, screens, spacers, and gaskets). | HP |
| 9.  | Inspect servo including bore, piston, seals, pin, spring, and retainers; repair or replace as needed  | HP |
| 10. | Inspect accumulator (includes bore, piston, seals, spring, and retainers); repair or replace as needed.   | HP |
| 11. | Inspect, test, adjust, repair, and/or replace transmission related electrical/electronic components (includes computers, solenoids, sensors, relays, and switches).       | HP |
| 12. | Inspect, replace, and align power train mounts.   | HP |

#### OFF-VEHICLE TRANSMISSION/TRANSAXLE REPAIR

##### Removal, Disassembly, Assembly, and Reinstallation

- |    |  |    |
|----|--|----|
| 1. | Remove and reinstall transmission and torque converter (rear wheel drive). | HP |
| 2. | Remove and reinstall transaxle and torque converter assembly.              | HP |
| 3. | Disassemble, clean, and inspect transmission (rear wheel drive).           | HP |
| 4. | Disassemble, clean, and inspect transaxle assembly.                        | HP |
| 5. | Assemble transmission (rear wheel drive).                                  | HP |
| 6. | Assemble transaxle.  | HP |

#### Oil Pump and Converter

- |    |   |    |
|----|---|----|
| 1. | Inspect converter flex plate, attaching parts, pilot and pump drive and seal areas.                         | HP |
| 2. | Measure torque converter end play and check for interference; check stator clutch.                          | HP |
| 3. | Inspect, measure, and replace oil pump housings, shafts, vanes, rotors, gears, valves, seals, and bushings. | HP |
| 4. | Flush torque converter and transmission cooling system.   | HP |
| 5. | Perform lock-up converter and control system checks.  | HP |

#### Gear Train, Shafts, Bushings, and Case

- |     |  |    |
|-----|--|----|
| 1.  | Check end play and/or preload; determine needed service.   | HP |
| 2.  | Inspect, measure, and replace thrust washers and bearings.   | HP |
| 3.  | Inspect and replace shafts.  | HP |
| 4.  | Inspect oil delivery seal rings including ring, ring groove, and sealing surface area.   | HP |
| 5.  | Inspect and replace bushings.  | HP |
| 6.  | Inspect and measure planetary gear assembly (includes sun, ring gear, thrust washers, and carrier assembly); replace as necessary. | HP |
| 7.  | Inspect, repair, or replace cases including bores, passages, bushings, vents, and mating surfaces.                                 | HP |
| 8.  | Inspect, repair or replace transaxle drive link chains, sprockets, gears, bearings, and bushings.                                  | HP |
| 9.  | Inspect, measure, repair, adjust or replace transaxle final drive components.  | HP |
| 10. | Inspect and replace parking pawl, shaft, spring, and retainer.   | HP |

#### Friction and Reaction Units

- |    |  |    |
|----|--|----|
| 1. | Inspect and replace clutch assembly (includes drum, piston, check balls, springs, retainers, seals, and friction/pressure plates). | HP |
| 2. | Measure and adjust clutch pack clearance.  | HP |
| 3. | Air test operation of clutch pack and servo assemblies.  | HP |
| 4. | Inspect and replace roller and sprag clutches (includes races, rollers, sprags, springs, cages, and retainers).                    | HP |
| 5. | Inspect and replace bands and drums.   | HP |

## MANUAL DRIVE TRAIN AND AXLES

### CLUTCH DIAGNOSIS AND REPAIR

### PRIORITY

- |     |  |    |
|-----|--|----|
| 1.  | Diagnose clutch noise, binding, slippage, pulsation, and chatter problems; determine needed repairs.                                 | HP |
| 2.  | Inspect, adjust, or replace clutch pedal linkage, cables and automatic adjuster mechanisms, brackets, bushings, pivots, and springs. | HP |
| 3.  | Inspect, adjust, repair, or replace hydraulic clutch slave and master cylinders, lines, and hoses.                                   | HP |
| 4.  | Inspect, adjust, or replace release (throw-out) bearing, lever, and pivot.   | HP |
| 5.  | Inspect and replace clutch pressure plate assembly and clutch disc.  | HP |
| 6.  | Inspect, remove or replace crankshaft pilot bearing/bushing (as applicable).   | HP |
| 7.  | Inspect, repair, and service or replace flywheel and ring gear.  | HP |
| 8.  | Inspect engine block, clutch (bell) housing, and transmission case mating surfaces; determine needed repairs.                        | HP |
| 9.  | Measure flywheel-to-block runout and crankshaft end play; determine needed repairs.  |    |
| 10. | Measure clutch (bell) housing bore-to-crankshaft runout and face squareness; determine needed repairs.                               |    |

### TRANSMISSION DIAGNOSIS AND REPAIR

- |    |  |    |
|----|--|----|
| 1. | Diagnose transmission noise, hard shifting, jumping out of gear, and fluid leakage problems; determine needed repairs. | HP |
| 2. | Inspect, adjust, and replace transmission shift linkages, brackets, bushings, cables, pivots and levers.               | HP |
| 3. | Inspect, replace and align power train mounts.   |    |
| 4. | Inspect and replace transmission gaskets, seals, and sealants; inspect sealing surfaces.                               | HP |
| 5. | Remove and reinstall transmission.   | HP |

- |     |   |    |
|-----|---|----|
| 6.  | Disassemble and clean transmission components.  | HP |
| 7.  | Inspect, adjust, and replace transmission shift cover, forks, grommets, levers, shafts, sleeves, detent mechanisms, interlocks and springs. | HP |
| 8.  | Inspect and replace input (clutch) shaft and bearings.  | HP |
| 9.  | Inspect and replace main shaft, gears, thrust washers, bearings, and retainers.   | HP |
| 10. | Inspect and replace synchronizer hub, sleeve, keys (inserts), springs, and blocking rings.  | HP |
| 11. | Inspect and replace counter (cluster) gear, shaft, bearings, thrust washers, and retainers; check end play; adjust as required.             | HP |
| 12. | Inspect and replace reverse idler gear, shaft, bearings, thrust washers, and retainers; check end play; adjust as required.                 | HP |
| 13. | Inspect lubrication devices.  | HP |
| 14. | Inspect, repair, and replace extension housing and transmission case (includes mating surfaces, bores, bushings, and vents).                | HP |
| 15. | Inspect and replace speedometer drive gear, driven gear, and retainers.   | HP |

#### TRANSAXLE DIAGNOSIS AND REPAIR

- |    |   |    |
|----|---|----|
| 1. | Diagnose transaxle noise, hard shifting, jumping out of gear, and fluid leakage problems; determine needed repairs. | HP |
| 2. | Inspect, adjust, and replace transaxle shift linkages, brackets, bushings, cables, pivots, and levers.              | HP |
| 3. | Inspect, replace and align power train mounts.  | HP |
| 4. | Inspect and replace transaxle gaskets, seals, and sealants; inspect sealing surfaces.                               | HP |
| 5. | Remove and replace transaxle final drive (as applicable).   | HP |
| 6. | Disassemble and clean transaxle final drive (as applicable).  | HP |

7. Inspect, adjust, and replace transaxle shift cover, forks, levers, grommets, shafts, sleeves, detent mechanisms, interlocks, and springs. HP
8. Inspect and replace input (clutch) shaft and bearings. HP
9. Inspect and replace output shaft, gears, thrust washers, bearings, and retainers. HP
10. Measure end play/preload (shim/spacer selection procedure) on all transaxle shafts; adjust as required. HP
11. Inspect and replace synchronizer hub, sleeve, keys (inserts), springs, and blocking rings. HP
12. Inspect and replace reverse idler gear, shaft, bearings, thrust washers, and retainers. HP
13. Inspect, repair, and replace transaxle case (includes mating surfaces, bores, bushings, and vents). HP
14. Inspect and replace speedometer drive gear, driven gear, and retainers. HP
15. Diagnose differential case assembly noise and vibration problems; determine needed repairs. HP
16. Remove and reinstall differential case assembly. HP
17. Inspect, measure, adjust and replace differential case assembly including pinion gears (spiders), shaft, side gears, thrust washers, and case. HP
18. Inspect and replace differential side bearings. HP
19. Inspect lubrication devices. HP

#### DRIVE (HALF) SHAFT AND UNIVERSAL JOINT DIAGNOSIS AND REPAIR

1. Diagnose front wheel drive (FWD) and rear wheel drive (RWD) shaft and universal/constant-velocity (CV) joint noise and vibration problems; determine needed repairs. HP
2. Diagnose FWD front wheel bearing noise and vibration problems; determine needed repairs. HP
3. Inspect, service, and replace FWD and RWD shafts, yokes, boots, and universal/CV joints. HP
4. Inspect, service, and replace shaft center support bearings. HP

5. Check shaft balance and run-out; determine needed repairs.
6. Measure and adjust shaft angles.

HP

#### REAR AXLE DIAGNOSIS AND REPAIR

##### Ring and Pinion Gears/Differential Case Assembly

1. Diagnose noise and vibration problems; determine needed repairs. HP
2. Diagnose fluid leakage problems; determine needed repairs. HP
3. Inspect and replace companion flange and pinion seal. HP
4. Inspect ring gear and measure runout; determine needed repairs. HP
5. Remove and inspect drive pinion gear, spacers, sleeves, and bearings. HP
6. Measure and adjust drive pinion depth. HP
7. Measure and adjust drive pinion bearing preload. HP
8. Measure and adjust side bearing preload and ring and pinion backlash on a differential carrier assembly (threaded cup and shim types). HP
9. Check ring and pinion tooth contact pattern; make needed adjustments. HP
10. Disassemble, inspect, measure, and adjust or replace differential case assembly including pinion gears (spiders), shaft, side gears, thrust washers, and case. HP
11. Inspect and replace differential side bearings. HP
12. Reassemble and reinstall differential case assembly; measure runout; determine needed repairs. HP

##### Limited Slip Differential

1. Diagnose noise, slippage, and chatter problems; determine needed repairs.

2. Inspect and flush differential housing; refill with correct lubricant.
3. Inspect, adjust, and replace clutch (cone/plate) components.
4. Measure rotating torque at a rear wheel; determine needed repairs.

#### Axle Shafts

- |  |    |
|--|----|
| 1. Diagnose rear axle shafts, bearings and seals for noise, vibration, and fluid leakage problems; determine needed repairs. | HP |
| 2. Diagnose fluid leakage problems; determine needed repairs   | HP |
| 3. Inspect and replace rear axle shaft wheel studs.  | HP |
| 4. Remove and replace rear axle shafts.  | HP |
| 5. Inspect and replace rear axle shaft seals, bearings, and retainers.   | HP |
| 6. Remove and replace axle shaft bearings (pressed-on type).   | HP |
| 7. Measure rear axle flange runout and shaft end play; determine needed repairs.   | HP |

#### FOUR-WHEEL DRIVE COMPONENT DIAGNOSIS AND REPAIR

- |  |    |
|--|----|
| 1. Diagnose four-wheel drive assembly noise, vibration, and unusual steering problems; determine needed repairs. | HP |
| 2. Inspect, adjust, and repair transfer case shifting mechanisms, bushings, mounts, levers, and brackets.        | HP |
| 3. Remove and reinstall four-wheel drive transfer case.  |    |
| 4. Inspect and service transfer case and components (includes checking lube level).                              | HP |
| 6. Inspect, service, and replace front-drive (propeller) shafts and universal joints.                            | HP |
| 7. Inspect, service, and replace front-drive axle knuckles and axle shafts.                                      | HP |
| 8. Inspect, service, and replace front-wheel bearings and locking hubs.  | HP |
| 9. Check four-wheel drive unit seals and remote vents.   | HP |

## SUSPENSION AND STEERING

<u>STEERING SYSTEMS DIAGNOSIS AND REPAIR</u>	<u>PRIORITY</u>
1. Diagnose steering column noises, looseness, and binding problems (including tilt mechanisms); determine needed repairs.	
2. Diagnose power steering gear (non-rack and pinion type) binding, uneven turning effort, looseness, hard steering, and fluid leakage problems; determine needed repairs.	HP
3. Diagnose manual steering gear (non-rack and pinion type) binding, uneven turning effort, looseness, hard steering, and fluid leakage problems; determine needed repairs.	
4. Diagnose power rack and pinion steering gear vibration, looseness, and hard steering problems; determine needed repairs.	HP
5. Diagnose manual rack and pinion steering gear vibration, looseness, and hard steering problems; determine needed repairs.	
6. Inspect and replace steering shaft Universal-joints(s), flexible coupling(s), collapsible columns, and steering wheel.	HP
7. Remove and replace manual/power steering gear (non-rack and pinion type).	
8. Disassemble, inspect, repair and reassemble manual steering gear (non-rack and pinion type).	
9. Adjust manual/power steering gear (non-rack and pinion type) worm bearing preload and sector lash.	HP
10. Remove and replace manual/power rack and pinion steering gear.	HP
11. Disassemble, inspect, repair and reassemble rack and pinion steering gear.	
12. Adjust manual/power rack and pinion steering gear.	HP
13. Inspect and replace manual/power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.	HP

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|--|----|
| 14. Inspect and replace rack and pinion steering gear mounting bushings and brackets.          | HP |
| 15. Inspect manual and power steering fluid levels and condition.                              | HP |
| 16. Flush power steering system.   | HP |
| 17. Diagnose power steering fluid leakage; determine needed repairs.                           | HP |
| 18. Inspect, adjust, and replace power steering pump belt(s).                                  | HP |
| 19. Remove and replace power steering pump; inspect pump mounts.                               | HP |
| 20. Inspect and replace power steering pump seals and gaskets.                                 | HP |
| 21. Inspect and replace power steering pump pulley.  | HP |
| 22. Perform power steering system pressure test; determine needed repairs.                     | HP |
| 23. Inspect and replace power steering hoses and fittings.                                     | HP |
| 24. Inspect and replace power steering gear (non-rack and pinion type) seals and gaskets.      |    |
| 25. Inspect and replace pitman arm.  | HP |
| 26. Inspect and replace relay (center link/intermediate) rod.                                  | HP |
| 27. Inspect and replace idler arm and mountings.   | HP |
| 28. Inspect, replace, and adjust tie rod (sockets), tie rod sleeves, clamps, and tie rod ends. | HP |
| 29. Inspect and replace steering linkage damper.   |    |

## SUSPENSION SYSTEMS DIAGNOSIS AND REPAIR

### Front Suspensions

- |   |    |
|---|----|
| 1. Diagnose short and long arm-type suspension system noises, body sway, and uneven riding height problems; determine needed repairs. | HP |
|---|----|

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|-----|---|----|
| 2.  | Diagnose MacPherson strut suspension system noises, body sway, and uneven riding height problems; determine needed repairs. | HP |
| 3.  | Inspect and replace upper and lower control arms.   | HP |
| 4.  | Inspect and replace upper and lower control arm bushings, shafts, and rebound bumpers.                                      | HP |
| 5.  | Inspect, adjust, and replace strut (compression/tension) rods and bushings.   | HP |
| 6.  | Inspect and replace upper and lower ball joints on short and long arm-type suspension systems.                              | HP |
| 7.  | Inspect and replace steering knuckle assemblies.  | HP |
| 8.  | Inspect and replace short and long arm type front suspension system coil springs and spring insulators.                     | HP |
| 9.  | Inspect, replace, and adjust front suspension system torsion bars; inspect mounts.  | HP |
| 10. | Inspect and replace stabilizer bar bushings, brackets, and links.   | HP |
| 11. | Inspect and replace ball joints on MacPherson strut suspension systems.   | HP |
| 12. | Inspect and replace MacPherson strut cartridge or assembly.   | HP |
| 13. | Inspect and replace front MacPherson strut coil spring and insulators.  | HP |
| 14. | Lubricate suspension/steering systems.  | HP |

#### Rear Suspensions

- |    |  |    |
|----|--|----|
| 1. | Inspect and replace rear suspension system coil springs and spring insulators.   | HP |
| 2. | Inspect and replace rear suspension system transverse links, control arms, bushings, and mounts.                                       | HP |
| 3. | Inspect and replace rear suspension system leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. | HP |
| 4. | Inspect and replace rear MacPherson strut cartridge or assembly.   | HP |

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|----|--|----|
| 5. | Inspect and replace rear MacPherson strut coil spring and insulators.          | HP |
| 6. | Inspect rear wheel drive axle assembly for bending, warpage, and misalignment. |    |

#### Miscellaneous Service

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|----|--|----|
| 1. | Inspect and replace shock absorbers.   | HP |
| 2. | Inspect and service/replace front and/or rear wheel bearings.  | HP |
| 3. | Diagnose, inspect, adjust, repair or replace components of electronically-controlled suspension systems. | HP |

#### WHEEL ALIGNMENT DIAGNOSIS, ADJUSTMENT, AND REPAIR

- |     |  |    |
|-----|--|----|
| 1.  | Diagnose vehicle wandering, pulling, hard steering, and poor steering return problems; determine needed repairs. | HP |
| 2.  | Measure vehicle riding height; determine needed repairs.   | HP |
| 3.  | Check and adjust front and rear wheel camber on suspension systems with a camber adjustment.                     | HP |
| 4.  | Check front and rear wheel camber on non-adjustable suspension systems; determine needed repairs.                | HP |
| 5.  | Check and adjust caster on suspension systems with a caster adjustment.  | HP |
| 6.  | Check caster on non-adjustable suspension systems; determine needed repairs.                                     | HP |
| 7.  | Check and adjust front wheel toe.  | HP |
| 8.  | Center steering wheel.   | HP |
| 9.  | Check toe-out-on-turns (turning radius); determine needed repairs.   | HP |
| 10. | Check SAI (steering axis inclination)/KPI (king pin inclination)/included angle; determine needed repairs.       | HP |
| 11. | Check and adjust (where applicable) rear wheel toe.  | HP |
| 12. | Check rear wheel thrust angle; determine needed repairs.   | HP |
| 13. | Check for front wheel setback; determine needed repairs.   | HP |

#### WHEEL AND TIRE DIAGNOSIS AND REPAIR

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|----|--|----|
| 1. | Diagnose unusual tire wear patterns; determine needed repairs.                       | HP |
| 2. | Inspect tires, check and adjust air pressure.  | HP |
| 3. | Diagnose wheel/tire vibration, shimmy, and tramp problems; determine needed repairs. | HP |
| 4. | Rotate tires according to manufacturer's recommendations.                            | HP |
| 5. | Measure wheel, tire, axle, and hub runout; determine needed repairs.                 | HP |
| 6. | Diagnose tire pull (lead) problems; determine corrective actions.                    | HP |
| 7. | Balance wheel and tire assembly (static or dynamic).                                 | HP |
| 8. | Dismount, inspect, repair and remount tire on wheel.                                 | HP |
| 9. | Reinstall wheel; torque lug nuts.  | HP |

## BRAKES

<u>HYDRAULIC SYSTEM DIAGNOSIS AND REPAIR</u>	<u>PRIORITY</u>
1. Diagnose poor stopping or dragging caused by problems in the master cylinder; determine needed repairs.	HP
2. Diagnose poor stopping, dragging, high/low pedal, or hard pedal caused by problems in a step-bore master cylinder and internal valves (includes volume control devices, quick take-up valve, fast-fill valve, pressure regulating valve); determine needed repairs.	HP
3. Measure and adjust pedal pushrod length.	HP
4. Check master cylinder for internal and external leaks and proper operation; determine needed repairs.	HP
5. Remove, bench bleed, and replace master cylinder.	HP
6. Diagnose poor stopping, pulling, or dragging caused by problems in the brake fluid, lines, and hoses; determine needed repairs.	HP
7. Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks, or wear; tighten loose fittings and supports.	HP
8. Inspect flexible brake hoses for leaks, kinks, cracks, bulging, or wear; tighten loose fittings and supports.	HP
9. Replace brake lines (double flare and ISO types), hoses, fittings, and supports.	HP
10. Select, handle, store and install brake fluids (includes silicone fluids).	HP
11. Diagnose poor stopping, pulling, or dragging caused by problems in the hydraulic system valve(s).	HP
12. Inspect, test, and replace metering (hold-off), proportioning (balance), pressure differential, and combination valves.	HP
13. Inspect, test, replace, and adjust load or height sensing-type proportioning valve(s).	HP
14. Inspect, test, and replace brake warning light system switch and wiring.	HP

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|---|----|
| 15. Reset brake pressure differential valve.                                  | HP |
| 16. Bleed (manual, pressure, vacuum, or surge) and/or flush hydraulic system. | HP |
| 17. Check and adjust master cylinder fluid levels.                            | HP |

#### DRUM BRAKE DIAGNOSIS AND REPAIR

- |  |    |
|--|----|
| 1. Diagnose poor stopping, pulling, or dragging caused by problems in the drum brake wheel assembly; determine needed repairs.   | HP |
| 2. Diagnose poor stopping, noise, pulling, grabbing, dragging, or pedal pulsation caused by problems in the drum brake mechanical assembly; determine needed repairs.  | HP |
| 3. Remove, clean (using proper safety procedures), inspect, and measure brake drums.   | HP |
| 4. Mount brake drum on lathe and machine braking surface.  | HP |
| 5. Remove, clean, and inspect brake shoes/linings, springs, pins, clips, levers, adjusters/self-adjusters, and other related brake hardware; determine needed repairs.   | HP |
| 6. Clean and remove loose dirt, rust, or scale on brake backing (support) plates (using proper safety procedures); inspect; remove and reinstall if necessary.   | HP |
| 7. Remove and reinstall/replace wheel cylinders.   | HP |
| 8. Disassemble and clean wheel cylinder assembly; inspect parts for wear, rust, scoring, and damage; hone cylinder (if necessary and recommended by manufacturer); replace all cups, boots, and any damaged or worn parts. |    |
| 9. Lubricate brake shoe support pads on backing (support) plate, adjuster/self adjuster mechanisms, and other brake hardware.  | HP |
| 10. Determine correct brake shoe application.  | HP |
| 11. Install brake shoes and related hardware.  | HP |
| 12. Adjust brake shoes and reinstall brake drums or drum/hub assemblies and wheel bearings.  | HP |
| 13. Reinstall wheel, torque lug nuts, and make final checks and adjustments.   | HP |

#### DISC BRAKE DIAGNOSIS AND REPAIR

- |   |    |
|---|----|
| 1. Diagnose poor stopping, pulling, or dragging caused by problems in the disc brake caliper assembly; determine needed repairs.                                      | HP |
| 2. Diagnose poor stopping, noise, pulling, grabbing, dragging, or pedal pulsation caused by problems in the disc brake mechanical assembly; determine needed repairs. | HP |
| 3. Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing.   | HP |
| 4. Clean and inspect caliper mountings and slides for wear and damage.  | HP |
| 5. Remove, clean, and inspect pads and retaining hardware; determine needed repairs, adjustments, and replacements.   | HP |
| 6. Remove, disassemble, and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace all seals, boots, and any damaged or worn parts.       | HP |
| 7. Reassemble and reinstall caliper.  | HP |
| 8. Clean and inspect rotor; measure rotor with a dial indicator and a micrometer.   | HP |
| 9. Remove rotor, mount on lathe, and machine (apply non-directional finish where applicable).   | HP |
| 10. Determine correct brake pad application.  | HP |
| 11. Install pads, calipers, and related attaching hardware.   | HP |
| 12. Adjust calipers with integrated parking brakes.   | HP |
| 13. Fill master cylinder with recommended fluid and seat pads; inspect caliper for leaks.   | HP |
| 14. Reinstall wheel and torque lug nuts, and make final checks and adjustments.   | HP |

#### POWER ASSIST UNITS DIAGNOSIS AND REPAIR

- |   |    |
|---|----|
| 1. Test pedal free travel with and without engine running; check power booster operation. | HP |
|---|----|

2. Check vacuum supply manifold or auxiliary pump to vacuum-type power booster with a vacuum gauge. HP
3. Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; repair or replace parts as necessary. HP
4. Inspect and test hydro-boost system and accumulator for leaks and proper operation; repair and replace parts as necessary.

MISCELLANEOUS WHEEL BEARINGS, PARKING BRAKES, ELECTRICAL.  
7.3. DIAGNOSTIC AND REPAIR

1. Diagnose wheel bearing noises, wheel shimmy and vibration problems; determine needed repairs. HP
2. Remove, clean, inspect, repack, or replace and pack wheel bearings, replace seals and adjust wheel bearings. HP
3. Check parking brake system; inspect cables and parts for wear, rusting, binding and corrosion; clean or replace parts as necessary; lubricate assembly. HP
4. Adjust parking brake assembly; check operation. HP
5. Test parking brake indicator lights, switches, and wiring. HP
6. Test, adjust, repair or replace brake stop light switch and wiring. HP

## ELECTRICAL SYSTEMS

<u>GENERAL ELECTRICAL SYSTEM DIAGNOSIS</u>		<u>PRIORITY</u>
1.	Use wiring diagrams to determine needed electrical circuit repairs.	HP
2.	Check continuity in electrical circuits using a test light; determine needed repairs.	HP
3.	Check applied voltages and voltage drops in electrical circuits using analog and digital voltmeters; determine needed repairs.	HP
4.	Check applied voltages in electrical circuits using an oscilloscope; determine needed repairs.	HP
5.	Check current flow in electrical circuits and components using an ammeter; determine needed repairs.	HP
6.	Check continuity and resistances in electrical circuits and components using analog and digital ohmmeters; determine needed repairs.	HP
7.	Check electrical circuits using jumper wires, determine needed repairs.	HP
8.	Find shorts, grounds, opens, and high resistance problems in electrical circuits; determine needed repairs.	HP
9.	Diagnose the cause(s) of abnormal battery drain; determine needed repairs.	HP
10.	Inspect, test, and replace fusible links, circuit breakers, and fuses.	HP
 <u>BATTERY DIAGNOSIS AND SERVICE</u>		
1.	Perform battery state-of-charge test; determine needed service.	HP
2.	Perform battery capacity (load, high-rate discharge) test; determine needed service.	HP
3.	Perform battery 3 minute charge test; determine needed service.	HP
4.	Inspect, clean, and fill battery.	HP

- |    |   |    |
|----|---|----|
| 5. | Replace and reinstall battery.  | HP |
| 6. | Perform slow/fast battery charge.   | HP |
| 7. | Inspect, clean, and repair or replace battery cables, connectors, and clamps.             | HP |
| 8. | Jump start a vehicle using jumper cables and a booster battery or auxiliary power supply. | HP |

#### STARTING SYSTEM DIAGNOSIS AND REPAIR

- |    |   |    |
|----|---|----|
| 1. | Perform starter current draw test; determine needed repairs.                                      | HP |
| 2. | Perform starter circuit voltage drop tests; determine needed repairs.                             | HP |
| 3. | Inspect, test, and repair or replace switches, connectors, and wires of starter control circuits. | HP |
| 4. | Inspect, test, and replace starter relays and solenoids.  | HP |
| 5. | Remove and replace/reinstall starter.   | HP |
| 6. | Disassemble, clean, inspect, test, and replace starter components; perform bench test.            | HP |

#### CHARGING SYSTEM DIAGNOSIS AND REPAIR

- |    |   |    |
|----|---|----|
| 1. | Diagnose charging system problems that cause an undercharge, a no-charge, or an overcharge condition. | HP |
| 2. | Inspect, adjust, and replace alternator drive belts, pulleys, and fans.                               | HP |
| 3. | Perform charging system output test; determine needed repairs.  | HP |
| 4. | Remove and replace regulator.   | HP |
| 5. | Perform charging circuit voltage drop tests; determine needed repairs.                                | HP |
| 6. | Inspect and repair or replace connectors and wires of charging circuits.                              | HP |
| 7. | Perform alternator oscilloscope pattern tests; determine needed repairs.                              | HP |

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|--|----|
| 3. Remove and replace/reinstall alternator.                        | HP |
| 9. Disassemble, clean, inspect, and replace alternator components. | HP |

#### LIGHTING SYSTEMS DIAGNOSIS AND REPAIR

##### Headlights, Parking Lights, Taillights, Dash Lights, and Courtesy Lights

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|--|----|
| 1. Diagnose the cause of brighter than normal, intermittent, dim, or no headlight operation.   | HP |
| 2. Inspect, replace, and aim headlights/bulbs.   | HP |
| 3. Inspect, test, and repair or replace headlight and dimmer switches, relays, sockets, connectors, and wires of headlight circuits.           | HP |
| 4. Diagnose the cause of intermittent, slow, or no retractable headlight assembly operation.   |    |
| 5. Inspect, test, and repair or replace motors, switches, relays, connectors, and wires of retractable headlight assembly circuits.            |    |
| 6. Diagnose the cause of brighter than normal, intermittent, dim, or no parking light and/or taillight operation.                              | HP |
| 7. Inspect, test, and repair or replace switches, relays, bulbs, sockets, connectors, and wires of parking light and taillight circuits.       | HP |
| 8. Diagnose the cause of intermittent, dim, no lights, or no brightness control of dash light circuits.  | HP |
| 9. Inspect, test and repair or replace switches, relays, bulbs, sockets, connectors, wires, and printed circuit boards of dash light circuits. | HP |
| 10. Diagnose the cause of intermittent, dim, or no courtesy light operation.   |    |
| 11. Inspect, test, and repair or replace switches, relays, bulbs, sockets, connectors, and wires of courtesy light circuits.                   |    |

#### Stoplights, Turn Signals, Hazard Lights, and Back-up Lights

- |    |  |    |
|----|--|----|
| 1. | Diagnose the cause of intermittent, dim, or no stoplight operation.  | HP |
| 2. | Inspect, test, and adjust or replace stoplight switch.   | HP |
| 3. | Inspect, test, and repair or replace bulbs, sockets, connectors, and wires of stoplight circuits.                    | HP |
| 4. | Diagnose the cause of no turn signal and hazard lights or lights with no flash on one or both sides.                 | HP |
| 5. | Inspect, test, and replace turn signal and hazard light switches and flasher units.                                  | HP |
| 6. | Inspect, test, and repair or replace bulbs, sockets, connectors, and wires of turn signal and hazard light circuits. | HP |
| 7. | Diagnose the cause of intermittent, dim, or no back-up light operation.  |    |
| 8. | Inspect, test, and repair or replace switches, bulbs, sockets, connectors, and wires of back-up light circuits.      |    |

#### GAUGES, WARNING DEVICES, AND DRIVER INFORMATION SYSTEMS DIAGNOSIS AND REPAIR

- |    |   |    |
|----|---|----|
| 1. | Diagnose the cause of intermittent, high, low, or no gauge readings. (Note: Diagnosing causes of abnormal charging system gauge readings is limited to dash units and their electrical connections; other causes of abnormal charging system gauge readings are covered in CHARGING SYSTEM DIAGNOSIS AND REPAIR.) | HP |
| 2. | Test and replace gauge circuit voltage regulators (limiters).   | HP |
| 3. | Inspect, test, and replace gauges and gauge sending units.  | HP |
| 4. | Inspect, test, and repair or replace connectors, wires, and printed circuit boards of gauge circuits.   | HP |

5. Diagnose the cause of constant, intermittent, or no warning light/driver information system operation. (Note: Diagnosing causes of abnormal charging system warning light operation is limited to dash units and their electrical connections; other causes of abnormal charging system warning light operation are covered in CHARGING SYSTEM DIAGNOSIS AND REPAIR.) HP
6. Inspect, test, and repair or replace blubs, sockets, connectors, wires, and electronic components of warning light/driver information system circuits. HP
7. Diagnose the cause of constant, intermittent, or no operation of audible warning devices.
8. Inspect, test, and repair or replace switches relays, timers, electronic components, printed circuits, connectors, and wires of audible warning device circuits.
9. Diagnose the cause(s) of intermittent, high, low, or no readings on electronic digital instrument clusters. HP
10. Inspect, test, repair or replace sensors, sending units, connectors, and wires of electronic digital instrument circuits. HP

#### HORN AND WIPER/WASHER DIAGNOSIS AND REPAIR

1. Diagnose the cause of constant, intermittent, or no horn(s) operation. HP
2. Test, and repair or replace horn(s), horn relay, horn button (switch), connectors, and wires of horn circuits.
3. Diagnose the cause of constant, intermittent, or no wiper operation; diagnose the cause of wiper speed control and park problems. HP
4. Replace delay (pulsing) wiper speed controls.
5. Replace wiper motor, wiper motor resistor, and park switch or relay.
6. Repair or replace switches, connectors, and wires of wiper circuits.
7. Diagnose the cause of constant, intermittent, or no windshield washer operation. HP

8. Replace washer motor or pump/relay assembly.
9. Repair or replace switches, connectors, and wires of washer circuits.

#### ACCESSORIES DIAGNOSIS AND REPAIR

##### Body

1. Diagnose the cause of slow, intermittent, or no operation of power-driven window(s) and/or sunroof. HP
2. Adjust, repair, or replace power-driven window(s) and/or sunroof regulators (linkages).
3. Repair or replace switches, relays, motors, connectors, and wires of power-driven window(s) and/or sunroof circuits.
4. Diagnose the cause of slow, intermittent, or no power seat operation.
5. Repair or replace switches, relays, solenoids, motors, connectors, and wires of power seat circuits.
6. Adjust or replace power seat gear box, cables, and slave units.
7. Diagnose the cause of poor, intermittent, or no rear window defogger operation.
8. Repair or replace switches, relays, window grid, blower motors, connectors, and wires of rear window defogger circuits.
9. Diagnose the cause of poor, intermittent, or no electric door and hatch/trunk lock operation.
10. Repair or replace switches, relays, actuators, connectors, and wires of electric door and hatch/trunk lock circuits.
11. Diagnose the cause of poor, intermittent, or no keyless lock/unlock device operation.
12. Repair or replace components, connectors, and wires of keyless lock/unlock device circuits.
13. Diagnose the cause of slow, intermittent, or no operation of electrically-operated convertible tops.

14. Repair or replace motors, switches, relays, connectors, and wires of electrically-operated convertible top circuits.
15. Diagnose the cause of poor, intermittent, or no operation of electrically-operated and electrically-heated components (mirrors, seats, windscreens, etc.).
16. Repair or replace motors, heating units, switches, relays, connectors, and wires of electrically-operated and electrically-heated component circuits.

#### Miscellaneous

1. Diagnose the cause of radio static and weak, intermittent, or no radio reception.
2. Repair or replace grounds, connectors, and wires of sound system circuits.
3. Inspect, test, and replace speakers.
4. Inspect, test, and replace radio antenna and lead.
5. Inspect, test, and repair or replace switches, motor, connectors, and wires of power antenna circuits.
6. Replace noise suppression components.
7. Trim (adjust) radio antenna.
8. Inspect, test, and repair or replace case, integral fuse, connectors, and wires of cigar lighter circuits.
9. Inspect, test, and repair or replace clock, connectors, and wires of clock circuits.
10. Diagnose the cause of unregulated, intermittent, or no operation of cruise control systems.
11. Repair or replace switches, relays, electronic control units, speed signal generators, connectors, and wires of cruise control circuits.
12. Adjust, and repair or replace cruise control speedometer cables, regulator, servo, and hoses.
13. Diagnose the cause of poor, intermittent, or no anti-theft system operation.

14. Repair or replace components, switches, relays, connectors, and wire of anti-theft system circuits.
15. Diagnose the cause(s) of the airbag warning light staying on or flashing; (Note: Follow manufacturers' safety procedures to prevent accidental deployment).
16. Inspect, test, repair, or replace the airbag, airbag module, sensors, connectors, and wires of the airbag system circuit(s); (Note: Follow manufacturers' safety procedures to prevent accidental deployment).

## HEATING AND AIR CONDITIONING

### A/C SYSTEM DIAGNOSIS AND REPAIR

### PRIORITY

1. Diagnose the cause of unusual operating noises of the A/C system. HP
2. Performance test (troubleshoot) the A/C system, (includes pressure gauge readings and visual and touch procedures); determine needed repairs. HP
3. Leak test A/C system and determine needed repairs. HP
4. Discharge, evacuate, and charge A/C system using recovery/recycling and charging equipment as required. HP
5. Inspect oil condition; measure and add oil to A/C system. HP

### REFRIGERATION SYSTEM COMPONENT DIAGNOSIS AND REPAIR

#### Compressor and Clutch

1. Diagnose A/C system problems that cause the pressure protection devices to interrupt system operation; determine needed repairs. HP
2. Replace A/C system pressure protection devices.
3. Inspect, adjust, and replace A/C compressor drive belts and pulleys. HP
4. Inspect, test, service, and replace A/C compressor clutch components or assembly. HP
5. Remove and replace A/C compressor and mountings. HP
6. Inspect and replace A/C compressor shaft seal assembly(s). HP
7. Inspect and replace A/C compressor valve assembly(ies) and gasket(s)/O-ring(s).

#### Evaporator, Receiver/Drier, Condenser, Etc.

1. Diagnose A/C system problems caused by too much moisture in the refrigerant. HP

2. Install A/C system filter.
3. Inspect, repair or replace A/C system mufflers, hoses, lines, fittings, and seals. HP
4. Inspect A/C condenser for air flow restrictions; clean and straighten fins as required. HP
5. Inspect, test, and replace A/C system condenser and mountings.
6. Inspect and replace receiver/drier or accumulator/drier. HP
7. Inspect, test, and replace expansion valve or orifice (expansion) tube. HP
8. Inspect, test, and replace evaporator.
9. Inspect and repair/replace evaporator housing water drain. HP
10. Inspect, test, and replace evaporator pressure control systems and devices.
11. Inspect and replace A/C system service (gauge connection) valves.

#### HEATING AND ENGINE COOLING SYSTEMS DIAGNOSIS AND REPAIR

1. Diagnose the cause of temperature control problems in the heater/ventilation system; determine needed repairs. HP
2. Diagnose window fogging problems; determine needed repairs. HP
3. Perform cooling system tests (pressure, combustion leakage, and temperature); determine needed repairs. HP
4. Inspect and replace engine cooling and heater system hoses and belts. HP
5. Inspect, test, and replace radiator, pressure cap, coolant recovery system. HP
6. Inspect, test, and replace thermostat, by-pass, and housing. HP
7. Inspect coolant; drain, flush, and refill with recommended coolant; bleed system. HP

- |     |  |    |
|-----|--|----|
| 3.  | Clean, inspect, test, and replace fan, fan clutch (electrical and mechanical), and fan shroud.     | HP |
| 9.  | Inspect, test, and replace heater/coolant control valve(s) (manual, vacuum, and electrical types). | HP |
| 10. | Replace heater core.   | HP |

#### OPERATING SYSTEMS AND RELATED CONTROLS DIAGNOSIS AND REPAIR

##### Electrical

- |    |  |    |
|----|--|----|
| 1. | Diagnose the cause of failures in the electrical controls of heating and A/C systems.  | HP |
| 2. | Inspect, test, repair, or replace A/C-heater blower motors, resistors, switches, relays, wiring, and protection devices.             | HP |
| 3. | Inspect, test, repair, replace or adjust A/C-controlled engine idle systems.   | HP |
| 4. | Inspect, test, repair, replace, or adjust A/C compressor load cut-off systems.   | HP |
| 5. | Inspect, test, repair or replace engine coolant/A/C condenser fan motors, relays, switches, sensors, wiring, and protection devices. | HP |

##### Vacuum/Mechanical

- |    |  |    |
|----|--|----|
| 1. | Diagnose the cause of failures in the vacuum and mechanical controls of the heating and A/C system.                                      | HP |
| 2. | Inspect, test, service, or replace A/C-heater control panel assembly.  | HP |
| 3. | Inspect, test, adjust, or replace A/C-heater control cables and linkages.  | HP |
| 4. | Inspect, test, or replace A/C-heater vacuum control switches, hoses, diaphragms(motors), vacuum reservoir, check valve, and restrictors. | HP |
| 5. | Inspect, test, or repair A/C-heater ducts, doors, hoses, and outlets.  | HP |

#### Automatic and Semi-Automotive Temperature Controls

1. Check operation of automatic and semi-automatic heating, ventilation and air-conditioning (HVAC) control systems. HP
2. Inspect, test, or replace in-vehicle ambient sensor systems.
3. Inspect, test, or replace power servo (vacuum or electric) system.
4. Inspect, test, or replace coolant temperature blower control system.
5. Inspect, test, or replace heater valve and controls.
6. Diagnose and repair air distribution system problems.
7. Inspect, test, or replace electric and vacuum motors, solenoids, and switches.

## ENGINE PERFORMANCE

<u>GENERAL ENGINE DIAGNOSIS</u>	<u>PRIORITY</u>
1. Interpret complaint; determine needed repairs.	HP
2. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed repairs.	HP
3. Diagnose the cause of unusual exhaust color, odor, and sound; determine needed repairs.	HP
4. Perform engine vacuum tests; determine needed repairs.	HP
5. Perform cylinder power balance test; determine needed repairs.	HP
6. Perform cylinder compression test; determine needed repairs.	HP
7. Perform cylinder leakage test; determine needed repairs.	HP
8. Diagnose engine mechanical, ignition, or fuel problems using an oscilloscope and/or engine analyzer; determine needed repairs.	HP
9. Inspect and calibrate infrared analyzer; inspect vehicle exhaust system; obtain exhaust emissions readings.	HP
10. Diagnose engine mechanical, ignition, fuel, or emissions control problems using an infrared exhaust analyzer; determine needed repairs.	HP
11. Perform analytic/diagnostic procedures on vehicle with on-board or self-diagnostic type computer systems; determine needed repairs.	HP
12. Inspect, test, adjust, or replace sensor and actuator components and circuits of electronic engine management systems.	HP

#### IGNITION SYSTEM DIAGNOSIS AND REPAIR

1. Diagnose no-starting, hard starting, engine misfire, poor driveability, abnormal combustion, power loss, and/or poor mileage problems on vehicle with electronic ignition systems; determine needed repairs. HP
2. Inspect, test, repair, or replace ignition primary circuit wiring and components. HP
3. Remove distributor; inspect, test, and service (includes drives, shaft, bushings, cam, breaker plate, and vacuum, mechanical, and/or electrical advance/retard units); reinstall distributor.
4. Inspect, test, service, repair or replace ignition system secondary circuit wiring and components. HP
5. Inspect, test, and replace ignition coil. HP
6. Check and adjust ignition system timing; verify timing advance. HP
7. Inspect, test, or replace electronic ignition wiring harness and connectors. HP
8. Inspect, test, and replace electronic ignition system pick-up sensor or trigger devices. HP
9. Inspect, test, and replace electronic ignition system control unit (module). HP
10. Diagnose distributorless ignition system (DIS) operation; service as required. HP
11. Diagnose operation of glow plug system; service as required.

#### FUEL AND EXHAUST SYSTEMS DIAGNOSIS AND REPAIR

1. Diagnose no-starting, hard starting, poor idle, flooding, hesitation, surging, engine misfire, power loss, poor mileage, and/or dieseling problems on vehicle with carburetor-type fuel systems; determine needed repairs. HP

2. Diagnose no-starting, hard starting, poor idle, flooding, hesitation, surging, engine misfire, power loss, poor mileage, and/or dieseling problems on vehicle with injection-type fuel systems; determine needed repairs. HP
3. Inspect fuel tank, fuel tank filter and fuel cap; inspect and replace fuel lines and hoses; check fuel for contaminants. HP
4. Inspect, test (pressure, vacuum, and volume), and replace fuel pumps, pump controls; inspect, service, and replace fuel filters. HP
5. Inspect, clean, adjust, test, repair, or replace cold-enrichment systems. HP
6. Remove and replace carburetor/fuel injection throttle body and adjust related linkages. HP
7. Rebuild carburetor (includes disassembling, cleaning, replacing faulty parts, and reassembly). HP
8. Inspect, clean or replace carburetor mounting plates, fuel injection air induction system, intake manifold, and gaskets. HP
9. Adjust carburetor idle speed and fuel mixture. HP
10. Adjust carburetor/fuel injection idle speed and fuel mixture on closed-loop fuel control systems. HP
11. Inspect, test, clean, adjust, or replace components of carburetor/fuel injection closed-loop fuel control systems. HP
12. Inspect and service air cleaner and element. HP
13. Remove and replace fuel injectors. HP
14. Perform fuel injector tests (resistance, spray pattern, and pressure drop). HP
15. Clean fuel injection system on vehicle. HP
16. Test the operation of turbocharger or supercharger system; determine needed repairs.
17. Remove, clean, inspect, and repair or replace turbocharger or supercharger system components.
18. Identify the causes of turbocharger or supercharger failure; determine needed repairs.

19. Remove and replace fuel tank.
20. Remove and replace fuel gauge sending unit.
21. Remove and replace diesel injectors, lines, and pump; bleed and time fuel system as needed.
22. Test diesel injector spray pattern.
23. Service diesel fuel filters.
24. Test oxygen (O<sub>2</sub>) sensor. HP
25. Remove and replace/reinstall oxygen (O<sub>2</sub>) sensor. HP
26. Inspect, service, and replace/reinstall exhaust manifold, exhaust pipes, mufflers, resonators, tail pipes, and heat shields. HP

#### EMISSIONS CONTROL SYSTEMS DIAGNOSIS AND REPAIR

##### Positive Crankcase Ventilation (PCV) System

1. Test the operation of the PCV system; determine needed repairs. HP
2. Inspect, test, service, and replace PCV valve, filter (breather cap), tubes, and hoses. HP

##### Spark Timing Control System

1. Test the operation of spark control system; determine needed repairs. HP
2. Inspect, test, repair, and replace electrical/electronic components and circuits of spark control system. HP
3. Inspect, test, repair, and replace thermal, mechanical or vacuum components and hoses of spark control system. HP

##### Idle Speed Control System

1. Test the operation of idle speed control system; determine needed repairs. HP

- |    |  |    |
|----|--|----|
| 2. | Inspect, test, adjust, or replace sensors, solenoids, vacuum valves, motors, switches, circuits, and hoses of idle speed control system. | HP |
| 3. | Test the operation of deceleration control system; determine needed repairs.   | HP |
| 4. | Inspect, test, adjust, or replace electrical components, circuits, vacuum components, and hoses of deceleration control system.          | HP |

Exhaust Gas Recirculation (EGR) System

- |    |   |    |
|----|---|----|
| 1. | Test the operation of EGR system; determine needed repairs.   | HP |
| 2. | Inspect, test, repair, or replace valve, valve manifold, and exhaust passages of EGR system.                            | HP |
| 3. | Inspect, test, repair, or replace vacuum/pressure controls, filter, and hoses of EGR system.                            | HP |
| 4. | Inspect, test, repair, or replace electrical/electronic controls and wiring of exhaust gas recirculation (EGR) systems. | HP |

Exhaust Gas Treatment: Air Injection Reaction (AIR); Catalytic Converter

- |    |   |    |
|----|---|----|
| 1. | Test the operation of pump-type air injection system; determine needed repairs.   | HP |
| 2. | Inspect, test, service, or replace pump, pressure relief valve, filter, pulley, and belt of pump-type air injection system. | HP |
| 3. | Inspect, test, or replace vacuum-operated air control valves and vacuum hoses of pump-type air injection system.            | HP |
| 4. | Inspect or replace electrical/electronic-operated air control valves and circuits of pump-type air injection system.        | HP |
| 5. | Inspect, service, or replace hoses, check valves, air manifolds, and nozzles of pump-type air injection system.             | HP |

- |    |  |    |
|----|--|----|
| 6. | Test the operation of exhaust pulse-type air injection system; determine needed repairs.           | HP |
| 7. | Inspect, test, or replace pulse air valve(s) and noses of exhaust pulse-type air injection system. | HP |
| 8. | Inspect, test, service, or replace converter catalyst or converter(s).                             | HP |

#### Inlet Air Temperature Control System

- |    |  |    |
|----|--|----|
| 1. | Test the operation of inlet air temperature control system; determine needed repairs.                          | HP |
| 2. | Inspect, test, or replace sensors, diaphragm, and noses of inlet air temperature control system.               | HP |
| 3. | Inspect, test, or replace heat stove shroud, hot air pipe, and damper of inlet air temperature control system. | HP |

#### Intake Manifold Heat Control System

- |    |  |    |
|----|--|----|
| 1. | Inspect, service, and replace manifold heat control (heat riser) valve(s).                                   | HP |
| 2. | Test the operation of electrical/vacuum/coolant-type manifold heat control system; determine needed repairs. | HP |
| 3. | Inspect, test, repair or replace components of electrical/vacuum/coolant-type manifold heat control system.  | HP |

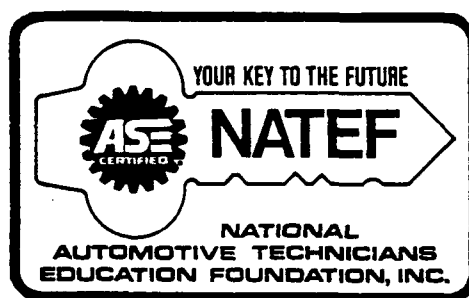
#### Fuel Vapor Control System

- |    |  |    |
|----|--|----|
| 1. | Test the operation of fuel vapor control system; determine needed repairs.   | HP |
| 2. | Inspect or replace fuel tank cap, liquid/vapor separator, liquid check valve, lines, and hoses of fuel vapor control system. | HP |
| 3. | Inspect, service, or replace canister, purge lines, and filter of fuel vapor control system.                                 | HP |
| 4. | Inspect, test, or replace thermal, vacuum, and electrical controls of fuel vapor control system.                             | HP |

#### ENGINE RELATED SERVICE

- |    |  |    |
|----|--|----|
| 1. | Adjust valves on engines with mechanical or hydraulic lifters.   | HP |
| 2. | Verify correct valve timing; determine needed repairs.   | HP |
| 3. | Verify engine operation temperature; determine needed repairs.   | HP |
| 4. | Perform cooling system pressure test; check coolant; inspect and test radiator, pressure cap, coolant recovery tank hoses; determine needed repairs. | HP |
| 5. | Inspect and replace thermostat, by-pass, and housing.  | HP |
| 6. | Inspect, test, and replace mechanical/electrical fans, fan clutch, fan shroud/ducting, and fan control devices.                                      | HP |

**AUTOMOTIVE  
TOOLS AND EQUIPMENT MANUAL  
FOR NATEF  
TECHNICIAN TRAINING  
CERTIFICATION PROGRAM**



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## TOOLS AND EQUIPMENT

Local employment opportunities and the availability of funds are key factors for determining the program's structure and operation of the automotive department. This section was developed recognizing that in the majority of programs, all of the tasks and specialty areas cannot be covered. Therefore, the basic philosophy is this: For the tasks which are covered, the training should be as thorough as possible.

The basic tools and equipment the shop and student should have for training in any given specialty areas are included in this section. Obviously, many tools and much equipment are the same for some or all of the specialty areas. Some equipment is specialized, however, and must be available in the shop to provide quality training. No specific brand names are identified because they will vary in each local situation.

The student hand tool lists cover all areas, and indicate the tools a student will need to own to be successful in each of all of the specialty areas. Industry surveys indicate that most (90%) employers require that a candidate for employment provide his/her own basic hand tool set in order to be hired as an entry level automobile technician.

STUDENT HAND TOOLS  
INDIVIDUAL OR TOOL CRIB IN SUFFICIENT  
QUANTITIES TO PERMIT EFFICIENT INSTRUCTION

Allen Wrench 2mm-7mm (.050 thru 3/8)  
Adjustable Wrench - 10"  
Battery Tools - Battery Nut Pliers  
                    Battery Terminal Clamp Puller  
                    Battery Post Cleaner  
Blow Gun - Rubber Tip (OSHA approved)  
Brake Spoon  
Chisel - 5/8" Cold Chisel  
            5/16" Cape Chisel  
Combination Wrenches - 7/16" - 1" (7mm - 19mm)  
Files - 10" Coarse. 6" Fine  
Hack Saw  
Hammers -           Medium Ball Peen  
                    Soft Face  
Magnetic Pickup Tool  
Mechanics Steel Ruler  
Pliers -            Needle nose  
                    All purpose  
                    Hose clamp  
                    Side cutters  
                    Vice Grip  
                    Slip joint (water pump)  
Punches -          1/4" and 1/8" Pin Punch  
                    3/8" Taper Punch  
                    3" Center Punch  
Safety Glasses  
Scraper - 1 1/2" wide  
Screwdrivers (Common) - Stubby 6", 12", 9" offset  
                    (Phillips) - Stubby #1 and #2  
                                6", #1 and #2  
                                12" #3  
                    Offset #2  
                    (Torx) - T-15, T-20, T-25, T-30  
Screw Starter (Standard and Phillips)  
Socket Set 1/4 Drive - 3/8"-1/2" Standard and Deep  
                    6mm - 12mm Standard and Deep  
                    Ratchet  
                    Long and Short Extension  
Socket Set 3/8" Drive - 5/16" thru 3/4" Standard (6 pt)  
                    3/8" thru 3/4" Deep (6 pt)  
                    6mm to 19mm  
                    9mm to 19mm Deep  
                    Universal Joint  
                    Ratchet Handle  
                    Short, medium and long extension  
                    Spark Plug Sockets - 5/8" and 13/16"  
                    Speed handle  
                    Breaker Bar

Spark Plug Gap Gauge  
Tape Measure  
Tire Pressure Gauge  
Tool Box  
Wire Brush

#### ADDITIONAL TOOLS

The tools on this list are used in the specialty areas.  
Program personnel must determine which tools are needed in each area.

Adjustable Wrench - 6"  
Allen Wrench - 2mm thru 7mm (.050" thru 3/8")  
Box End Wrench Set - (3/8" - 1 1/8") 7mm - 18mm  
                                    3/8" - 3/4" Offset (optional)  
                                    7mm - 15mm Offset (optional)  
Belt Tension Gauge  
Brake Tools - Brake Cylinder Hone  
                    Brake Cylinder Clamps  
                    Brake Spring Installer  
                    Brake Plier  
                    Brake Rotor Gauge  
Creepers  
Chisels - 3/8", 3/4" Cold Chisel  
Compression Tester  
Continuity Test Light  
Dial Indicator Set  
Digital Electronic Volt Meter  
Drag Link & Shock Tool  
Drill - 3/8" Variable Speed, Reversible  
Drill Bits - 1/16"-3/8"  
Easy Outs - 1 set  
Filter Wrench - Oil and Gas  
Engine Tools - Cylinder Hone  
                                    Piston Ring Extender  
                                    Piston Ring Compressor  
                                    Ridge Remover  
                                    Telescopic Gauge  
                                    Valve Spring Compressor  
Feeler Gauges - .002" .040" set, .006mm - .070mm set  
Files and Handles - 4", 10" and 12" fine  
                                    6" and 12" coarse  
                                    6" and 12" half round  
Flare Nut Wrench Set - 3/8" - 1 1/16". 7mm-17mm  
Hammers - Heavy Ball Peen, 24 oz Brass, Hand Sledge 5 lb  
Ignition Wrench - Metric Set, Standard Set  
Impact Ratchet Wrench - 3/8" Drive with Socket set  
                                    Standard and Metric  
Impact Wrench - 1/2" Drive with Sockets  
Micrometers - 0-1", 1-2" 2-3", 3-4", and 4-5"  
                                    0-25mm, 25-50mm, 50-75mm, 75mm-125mm

Oil Can Pump Type  
 Open End Wrench Set - 5/16" - 7/8", 8mm-19mm  
 Pitman Arm Pry Bar  
 Pliers - Snap Ring  
     Wheel Weight  
 Punches - 5/16", 3/16" Pin, 1/2", 5/8" Tapered, 6" Center Punch  
 Pry Bar - 16"  
 Puller - Two Way  
     Three Way  
 Roll-Around Tool Cabinet  
 Scraper - Carbon Remover  
 Screw Pitch Gauge - N.F., N.C., Metric  
 Screwdriver (Clutch Head) 3/16", 5/16", 1/4", 3/8"  
 Socket Set 1/2" Drive - 10mm - 25mm Standard  
     10mm - 25mm Deep  
     7/16" - 1 1/8" Standard  
     1/2" - 1 1/8" Deep  
     Ratchet  
     Speed Handle  
     Flex Handle (Breaker Bar)  
     Short, medium and long extension  
 Socket Set 1/4" Drive - 3/8"-1/2" Standard and Deep  
     6mm - 12mm " " "  
     Ratchet  
     Short and long extension  
 Soldering Gun  
 Spark Plug Wire Remover  
 Tach/Dwell Meter - Electronic Capabilities with Digital and  
     Analog  
 Tap and Die Set - Standard and Metric  
 Timing Light with Inductive Pickup  
 Magnetic Timer  
 Top Tool Chest - 6 Drawer Minimum  
 Torque Wrench - 1/2" Drive, 0-150 ft/lbs -- 0-200 Nm  
     " - 3/8" Drive, 5-75 ft/lbs -- 5-100 Nm  
 Tubing cutter with flaring tool, double flare type  
 Vacuum/Pressure Gauge  
 Water Manometer  
  
 Battery Post Cleaner, Top/side Post  
 Brake Adjusting Gauge/Universal Brake Spoon  
 Combination Wrenches - Start with 9/32 to 7/8, 6mm to 19mm  
 Feeler Gauge - .002" - .040" + .006mm - 1070mm  
 Flare Nut Wrench Set 3/8" - 3/4", 10mm - 17mm  
 Tubing Cutter  
 Easy Out Set  
 32oz. Hammer, 12 oz. Ball Peen Hammer  
 Inspection Mirror  
 Plastic or Wooden Mallet  
 Brass Hammer  
 Magnetic Pickup Tool - (three sizes) Set of Pick-up Fingers  
 Fender and Seat Covers  
 Brass or Aluminum Punch - 6"  
 12 Volt Test Light

16" Pry Bar  
 Tire Chuck  
 Tire Valve Core Remover  
 Ignition Wrench Set, Metric and Standard  
 Special Scraper for Aluminum Parts  
 Torx Complete Set All Sizes  
 Allen Wrench, 2mm - 14mm, .50 - 3/8"  
 Remote Starter Switch  
 Box End Wrench Set 1/4" - 1 1/8", 7mm - 19mm,  
     3/8" - 3/4" Offset  
 Open End Wrench Sets, 5/16" - 7/9", 8mm - 19mm  
 Chisels 3/8" - 3/4"  
 Drill Bits 1/64" - 1/2"  
 Torque Wrench Set 3/8" Drive 0-200 in lbs.  
 Torque Wrench Set 1/2" Drive 5-150 in lbs.  
 Flashlight

Adjustable wrench 6", 8", 12"  
 Crows Foot Wrench Set, Metric and Standard  
 Thread Chaser Set  
 1/2" Drill, Variable Speed, Reversible  
 Files and Handle, Complete Set  
 Impact Wrench 1/2" Drive with Complete Socket Set, Deep &  
     Standard  
 Flare Nut Wrench Set, to 3/4", to 19mm  
 Inside Micrometers, 0-6" and 0-150mm  
 Pliers Snap Ring, add Complete Set Reversible  
 12" Aligning Punch  
 Flex Socket Set - 1/4", 3/8", and 1/2" Drives Metric &  
     Standard  
 On Board Computer Tester - Hand Held

#### SHOP TOOLS AND EQUIPMENT

This section covers the tools and equipment a shop should have for training in any given specialty area. Obviously, many of the tools and equipment are the same for some or all of the specialty areas. Some equipment is specialized however, and to provide quality it must be available in the shop. No specific type or brand names are identified because they will vary in each local situation.

Note: All shops are assumed to have an air compressor, adequate electrical capability, fender covers and steel work benches with vises.

#### FRONT END

Axle Stands  
 Bearing Packer - hand operated  
 Chassis Lubricator System  
 Floor Jack(s) 2 ton minimum

Hoist(s) - Swing Arm Frame Contact  
 Hydraulic Press with adapters - 25 ton  
 Oxy-Acetylene Welder & Cutting Torch  
 Parts Cleaning Tank  
 Tire Mounting Machine  
 Wheel Alignment equipment - 2 wheel/4 wheel type (including  
     front end tools)  
     rack or pit type  
 Wheel Balancer - 1) On Car Spin Balancer  
                   2) Off Car Electronic Type  
 Spring/Strut Compressor Tool  
 Air Chisel with Adapter  
 Tie Rod Puller  
 Ball Joint Press and other Special Tools  
 Pressure Gauge - Tire  
 Dial Indicator Sets  
 Impact Wrench 1/2" Drive, and Sockets

#### BRAKES

Axle Stands  
 Bearing Packer, hand operated  
 Bench Grinder  
 Brake Bleeder, Pressure  
 "Brake shop", mobile with disc attachments  
 Dial Indicator  
 Floor Jack - 2 Ton  
 Hoist(s) - Swing Arm Frame Contact  
 Hydraulic Press - with adapters 25 Ton  
 Oxy-Acetylene Welder - Cutting Torch  
 Parts Cleaning Tank  
 Puller(s)  
 Torque Wrench 1/2" Drive 0-150 ft. lbs  
     "          "      3/8" Drive 5-75 ft. lbs  
 Brake Drum Micrometers  
 Rotor Gauge  
 Brake Disk Micrometer  
 Method for Removing Asbestos Contamination

#### HEATING AND AIR CONDITIONING

Air Conditioner Repair Unit, consisting of pullers, removers,  
 adapters, special feeler gauges, tools, system analyzer,  
 necessary hoses, leak detector, circuit tester, thermometer,  
 ratchet, refrigerant can, dispenser valves, and portable vacuum  
 pump.  
 Axle Stands  
 Bench Grinder  
 Cooling System Tester  
 Dial Indicator  
 Floor Jack - 2 Ton Minimum  
 Gear Puller(s)  
 Hydraulic Press - 25 Ton  
 Oxy-Acetylene Welder

Digital Volt, Ohm, Amp meter with adapters  
Torque Wrench Set 1/2" Drive 0-150 ft lbs  
" " " 3/8" " 0-75 ft lbs  
Belt Tension Gauge  
Service Port Adapter Set

#### PERFORMANCE

Arbor Press or Hydraulic Press - 25 Ton with adapters  
Axle Stands  
Battery Charger  
Battery/Starter Tester  
Bench Grinder  
Dial Indicator Set  
Engine Analyzer - with or without scope  
Four Gas Analyzer  
Floor jack, 2 Ton Minimum  
Parts Cleaning Tank  
Puller Set  
Spark Plug Cleaner  
Digital Volt Meter - with adapters  
Cylinder Leakage Tester  
Belt Tension Gauge  
Torque Wrench Set - 1/2" Drive 0-150 ft lbs  
" " " 3/8" " 0-75 ft lbs  
Computer Diagnostic Tester, Hand Held  
Fuel Injection Pressure Gauge Sets  
Advanced Timing Light  
Hand held Dwell Meters  
Computer Carburetor Tools  
Carburetor Plug and Angle Gauge Set  
Fuel Injection Cleaner  
Pyrometer  
Vacuum Gauges and Vacuum Pump  
Manometer

#### AUTOMATIC TRANSMISSION/TRANSAXLE

Arbor Press  
Axle Stands  
Bench Grinder  
Floor jack(s) - 2 ton Minimum  
Hoist(s), Swing Arm contact  
Transmission Cleaning System  
Hydraulic Press - 25 Ton with adapters  
Parts Cleaning Tank  
Puller Sets  
Transmission Jack(s)  
Transmission Holding Fixtures  
Transmission Special Tool Sets  
Hydraulic Pressure Gauge Set  
Front Wheel Engine Support Fixture  
Dial Indicator Set  
Digital Electronic Volt/Ohm Meter

Tach Dwell Meter  
 Torque Wrench 1/2" Drive 0-150 ft lbs  
 " " 3/8" Drive 0-75 ft lbs  
 " " 1/4" Drive 0-75 in lbs  
 Tap and Die Set, Standard and Metric  
 Waste Oil Receptacle with Extension Neck and Funnel  
 Computer Diagnostic Tester, Hand Held

#### ELECTRICAL SYSTEMS

Arbor Press  
 Axle Stand(s)  
 Battery Charger  
 Floor Jack(s) - 2 Ton Minimum  
 Grinder  
 Parts Cleaning Tank  
 Puller Set  
 Volt-Ampere Tester  
 DOVM Digital  
 Computer Diagnostic Tester, Hand Held  
 Engine Analyzer (Scope)  
 Analog Volt/Ohmmeter  
 Alternator Service Tools

#### MANUAL DRIVE TRAIN AND AXLES

Axle Stand(s)  
 Bench Grinder  
 Brake Bleeder  
 Dial Indicator Set  
 Floor Jack(s) - 2 Ton Minimum  
 Hoist(s) - Swing Arm Frame Contact  
 Holding Fixtures  
 Cleaning System  
 Hydraulic Press - 25 Ton with adapters  
 Lube Dispenser  
 Oxy-Acetylene Welder  
 Parts Cleaning Tank  
 Portable Crane - 2 Ton  
 Puller Sets  
 Transmission Jack(s)  
 Drain Pans  
 Special Tools for Transaxles  
 Front Wheel Drive Engine Support Fixture  
 Torque Wrench 1/2" Drive 0-150 ft lbs  
 " " 3/8" Drive 0-75 ft lbs  
 " " 1/4" Drive 0-75 in lbs  
 C V Joint Tools  
 Universal Joint Tools

## ENGINE

Axle Stand  
Bench Grinder(s)  
Engine Analyzer  
Floor Jack(s) - 2 Ton Minimum  
Gear Puller Set  
Hydraulic Press - 25 Ton with adapters  
Parts Cleaner  
Portable Crane - 2 Ton  
Steam or Detergent Cleaner  
"Valve Shop" including refacer and seat grinder, and  
Valve Guide Repair Unit  
1/2" Drill Motor  
1/2" Drive Impact Wrench  
Impact Socket Sets, 1/2" Drive, Std. and Deep  
Cam Bearing Driver Set  
Valve Spring Tester  
Engine Stands  
Piston Pin Press and Adaptors  
Compression Gauge  
Cylinder Leakage Tester  
Cylinder Hone  
Dial Indicator Sets  
Electronic Digital Volt/Ohm/Amp Meter  
Tap and Die Set  
Torque Wrench 1/2" Drive 0-200 ft lbs  
" " 3/8" Drive 0-75 ft lbs  
Telescopic Gauges  
Ball Gauges

Appendix C: NATEF Self-Evaluation Application  
and Narrative Justification



DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY  
AIR FORCE INSTITUTE OF TECHNOLOGY  
WRIGHT-PATTERSON AIR FORCE BASE OH 45433-6583

REPLY TO  
ATTN OF  
SUBJECT

Captains James J. Meersman and Inez A. Sookma  
AFIT/LSG  
Wright-Patterson AFB, OH 45433-6583  
NATEF Self-Evaluation

21 May 1992

TO

Ms. C.J. Williams  
Dr. Byrl Shoemaker  
National Automotive Technicians Education Foundation, Inc.  
13505 Dulles Technology Dr.  
Herndon, VA 22071-3415

Dear Ms. Williams and Dr. Shoemaker,

We have enclosed the completed NATEF Supplemental Sheet Report Form for your review. We would appreciate an honest and in-depth appraisal of how our military school house compares to your standards.

Again, our purpose in applying the NATEF self-study is strictly for research in our thesis. Our objective is to compare the United States Air Force's (USAF) automotive training program with the best in the civilian automotive training industry. We will analyze specific areas of commonality and/or deficiency. We have also included a narrative explanation for low-score or non-applicable items, and a general background paper on training operations at Chanute Air Force Base, Illinois.

If you have any questions, or need more information, please do not hesitate to contact us by telephone (513)255-8989, or fax (513)255-8458. Thank you in advance for your response and all the support you have provided for us.

*James J. Meersman*  
JAMES J. MEERSMAN, Capt, USAF  
Transportation Officer

*Inez A. Sookma*  
INEZ A. SOOKMA, Capt, USAF  
Transportation Officer

- 3 Atch  
1. Supp. Sheet Report Form  
2. Narrative Explanations  
3. Chanute Background Paper

STRENGTH THROUGH KNOWLEDGE

**SELF-EVALUATION APPLICATION**  
**ASE PROGRAM CERTIFICATION THROUGH NATEF**  
 (A separate application must be completed for each program)

**1. NAME OF INSTITUTION:**

USAF Automotive Technology Division  
 Name \_\_\_\_\_  
 Street \_\_\_\_\_  
 Chanhute Air Force Base, IL 61868  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Telephone Number ( ) \_\_\_\_\_

**2. ADMINISTRATOR FOR INSTITUTION:**

Capt James J. Meersman and Inez A. Sookma  
 Name \_\_\_\_\_ Title \_\_\_\_\_  
 AFIT/LSG  
 Street \_\_\_\_\_  
 Wright-Patterson Air Force Base, OH 45433-6583  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**3. PERSON RESPONSIBLE FOR COORDINATION OF SELF-EVALUATION:**  
 (Same as Number 2)

Name \_\_\_\_\_ Title \_\_\_\_\_  
 Street \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**4. LEVEL OF PROGRAM BEING EVALUATED:**

(If both sec and post sec students are taught in this program, check other) \_\_\_\_\_ secondary  
 \_\_\_\_\_ post secondary  
☒ other \*MILITARY

**5. OUR PROGRAM'S HOURS MEET NATEF'S MINIMUM HOUR REQUIREMENT**

(Choose at least 3 areas. Mark chosen areas in column 1. List total number of lab or shop instruction hours in column 2. List classroom hours of related instruction in column 3.)

1	2	3	
<input type="checkbox"/>	12.5	18.5	(a) Automatic Trans-
<input type="checkbox"/>	17.5	29.0	mission/Transaxle
<input type="checkbox"/>	29.0	26.0	(b) Brakes
<input type="checkbox"/>	86.5 *1	64.5 *2	(c) Electrical
<input type="checkbox"/>	34.5 *3	30.0 *4	Systems
<input type="checkbox"/>	9.0	9.0	(d) Engine
<input type="checkbox"/>	13.0	23.0	Performance
<input type="checkbox"/>	14.5	26.5	(e) Engine Repair
<input type="checkbox"/>			(f) Heating & Air
<input type="checkbox"/>			Conditioning
<input type="checkbox"/>			(g) Manual Drive
<input type="checkbox"/>			Train and Axles
<input type="checkbox"/>			(h) Suspension and
<input type="checkbox"/>			Steering

\*1: includes 62 hrs for diesel

\*2: includes 30.5 hrs for diesel \*4: includes 10.5 hrs for diesel

\*3: includes 10 hrs for diesel

#### JUSTIFICATION FOR LOW OR N/A RATINGS

1.1.A. - N/A: Not applicable because all students receive placement in jobs at military installations, immediately upon training completion.

1.1.B. - 1: The Air Force's automotive advisory committee, The Utilization and Training Workshop (U&TW), does not meet on an annual basis, but meets as required. On average, the U&TW meets every five years to update the Air Force automotive curriculum.

1.2 - N/A: The USAF does not provide a brochure or catalog of program description/goals, because a student's placement in the vehicle maintenance training program is based upon his/her score on the Armed Services Vocational Aptitude Battery (ASVAB), and upon the needs of the Air Force.

2.1 - N/A: The certificate a student receives upon completion of the course does not clearly specify the area(s) of demonstrated competency, because those areas are indicated in detail in the student's Specialty Training Skills (STS) record, which is maintained by the student's supervisor at his/her duty station.

2.5.A. - 1: The U&TW last met in February 1992; the prior meeting was held in April 1984. Therefore, they have not met two or more times a year.

2.5.E. - N/A: Consumer interests are not addressed by the advisory committee, because military vehicle maintenance functions do not deal with external consumers.

2.6 - N/A: Public relations materials are not distributed to the community because the training program does not deal with the local civilian community, but with the military sector.

4.4 - N/A: Budget status reports are mainly used by the administration, and not required by the instructional staff.

5.1 and 5.2 - N/A: Pre-testing and pre-admission interviews are conducted at military processing centers prior to the trainees' arrival at the automotive training center.

5.4 - N/A: Student placement is determined by the military personnel center prior to the students' arrival at the automotive training center.

5.5.D. - N/A: Program graduates do not have the option of employment outside of military transportation organizations.

6.1.B. - N/A: The military requires only one training path for an apprentice general purpose mechanic, due to standardization.

6.3 - 2.5: The instructors are not given adequate time for daily planning.

6.12 - N/A: Trainees are required to possess high school level mathematics, science, communications, and interpersonal relations prior to selection for automotive training.

6.14.F. - 3: The advisory committee (U&TW) does review the task listing, however, only once every five years on average.

6.15 - N/A: Live work is not included in the military vehicle mechanic training program. Certain regulations prohibit the school from doing so in order to prevent potential abuse of training resources/facilities.

6.16 - N/A: Agreements are not necessary among the five different specialty programs taught at the school, because there is no potential for duplication.

7.8.B. - N/A: Students are not encouraged to purchase a hand tool set because the military provides all necessary equipment during training and at their follow-on military assignments.

8.8.B. - N/A: Students do not require lockers.

8.10 - N/A: An on-base hospital provides all necessary first aid required.

8.11 - 1: The advisory committee (U&TW) does not conduct an annual evaluation.

\*Standard 9: Chanute has 20 general purpose automotive instructors (14 military, 6 civilian). The self-evaluation application lists statistics on 5 randomly selected instructors. Of the remaining 15 instructors, none are NATEF-certified, and they have an average of 7 years of general purpose automotive experience. They all have an average of at least one year of post-high school education, with all military instructors currently working towards an associates degree.

9.2 - N/A: Military instructors are exempt from state certification.

9.5 - N/A: The Air Force does not need to maintain a separate pool of substitute instructors. Any substituting is done internally with the full-time staff.

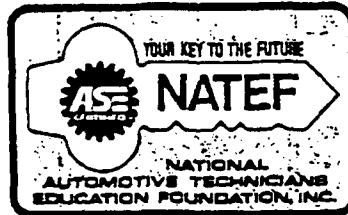
Standard 10 - N/A: The Air Force does not maintain any cooperative agreements with civilian automotive repair

organizations. An apprentice mechanic in the program receives fifty-seven days of training, and is then assigned to an operational vehicle maintenance shop. Therefore, the Air Force does not feel it is necessary to maintain internal cooperative agreements with operational air bases, due to the short training period.

## Appendix D: NATEF Report

JUN-11-92 THU 14:59

P. 01



### Memorandum:

To: Captain James J. Meersman  
AFIT/LSG  
Wright Patterson Air force Base Oh 45433 - 6583  
FAX 513 255 8458

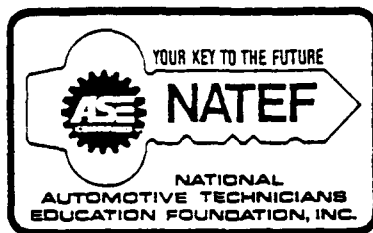
From: Byrl R. Shoemaker, Ph.D.  
Educational Consultant NATEF  
92 Ceramic Drive  
Columbus, Ohio 43214 3004  
FAX 614 263 3939

Date: June 11, 1992

A formal report will be forwarded by the National NATEF Office. The following comments are in addition to the specific items which will be identified in the report:

1. The program does not come close to meeting the standards established by the automotive industry for training entry level technicians;
2. The course of study is very incomplete in terms of the depth of instruction in the tasks required of entry level technicians;
3. The hours of instruction is approximately one-fourth of the minimum hours required by industry standards. The MINIMUM number of hours required by industry standards is 1000 for all eight specialty areas. Entry level programs established by manufacturers, such as G.M., Ford, Chrysler, require approximately 2200 hours.

Action should be taken to have the entry level automotive technician training programs to meet industry standards.



July 16, 1992

Captain James J. Meersman  
AFIT/LSG  
Wright-Patterson AFB, OH 45433

Dear Captain Meersman,

I have received and reviewed the self-evaluation revisions for your automotive training program. Your efforts are appreciated, however, your program still does not meet the requirements for a team evaluation. Here is an updated version of improvements needed:

Standard 9 averaged 3.83 instead of the 4.0 minimum requirement.  
Automatic Transmission/Transaxle is short 55% of the high priority items and short 69 hours in the course of study.  
Brakes are short 30% of the high priority items and short 33.5 hours in the course of study.  
Electrical Systems are short 23% of the high priority items and short 145 hours in the course of study.  
Engine Performance is short 23% of the high priority items and short 181.5 hours in the course of study.  
Engine Repair is short 47% of the high priority items and is short 76 hours in the course of study.  
Heating & Air Conditioning is short 25% of the high priority items and short 82 hours in the course of study.  
Manual Drive Train and Axles are 63% short of the high priority items and is short 104 hours in the course of study.  
Suspension & Steering is short 46% of the high priority items and is short 59 hours in the course of study.

Thank you for your patience in waiting for this letter. If you need further information to complete your project please call the NATEF office or you may call me at (614) 263-2139.

Sincerely,

Byrl R. Shoemaker, Ph.D.  
Ed Consultant, NATEF

BRS/mcs  
Enclosure  
cc: Captain Inez Sookma

13505 Dulles Technology Drive • Herndon, Virginia 22071-3415 • (703) 713-0100

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### Vita

Captain James J. Meersman was born on 8 May 1960, in Denver, Colorado. He graduated from Colorado State University in 1982 with a Bachelor of Science in Industrial Science. Upon completion of Officer Training School, he was commissioned in August 1988, and immediately entered into active duty service. His first duty station was at the 1st Mobile Aerial Port Squadron, Dyess AFB, Texas, where he worked with the air transportation system. Then he was transferred to Torrejon AB, Spain, where he worked surface transportation issues in the 401st Transportation Squadron. He entered the School of Systems and Logistics, Air Force Institute of Technology, in May 1991.

Permanent Address: 1930 Constitution Ave.

Fort Collins, Colorado 80526

### Vita

Captain Inez A. Sookma was born on 8 November 1964, in Dallas, Texas. She graduated from Texas A&M University in 1987 with a Bachelor of Science in Health Education. She was commissioned through the Reserve Officers' Training Corps, and entered active duty in 1988. Her first duty station was at the 351st Transportation Squadron, Whiteman AFB, Missouri, where she worked surface transportation issues. While at Whiteman, she was selected as the Strategic Air Command Outstanding Company Grade Transportation Officer and Mobility Officer for 1989. In 1990, she was assigned to the 624th Aerial Port Squadron, Clark AB, Republic of the Philippines, where she worked with the air transportation system. She entered the School of Systems and Logistics, Air Force Institute of Technology, in May 1991.

Permanent Address: 5742 Vanderbilt Ave.

Dallas, Texas 75206

# REPORT DOCUMENTATION PAGE

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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE September 1992	3. REPORT TYPE AND DATES COVERED Master's Thesis
4. TITLE AND SUBTITLE  A BENCHMARK OF VEHICLE MAINTENANCE TRAINING BETWEEN THE U.S. AIR FORCE AND A CIVILIAN INDUSTRY LEADER			5. FUNDING NUMBERS
6. AUTHOR(S)  James J. Meersman, Captain, USAF Inez A. Sookma, Captain, USAF			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  Air Force Institute of Technology, WPAFB OH 45433-6583			8. PERFORMING ORGANIZATION REPORT NUMBER  AFIT/GLN/LSM/92S-32
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11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY STATEMENT  Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words) This thesis compared vehicle maintenance training between the U.S. Air Force (USAF) and a leading civilian training organization, Cuyahoga Valley Joint Vocational School (CVJVS), using benchmarking. First, the study identified how the USAF and civilian automotive training industries conduct training. Next, the researchers identified common areas for comparison between training programs. Then, the industry leader's best practice was identified. The best practice at CVJVS was the National Automotive Technicians Education Foundation (NATEF) certification process. In applying this practice at Chanute, the researchers identified three deficient areas, or negative gaps. The first gap was in the number of hours of instruction. The second gap was the lack of high priority tasks included in Chanute's curriculum. The third gap was in Chanute's infrequency of returning instructors to the automotive industry for update training. Finally, three further findings were revealed. Chanute's acquisition process of vehicle trainers has not provided the latest vehicle technology. Chanute's advisory committee, the Utilization and Training Workshop, does not convene often enough to address training needs in a timely manner. Finally, Chanute has applied computer-based instruction and distance-learning to an extent not observed at other civilian training organizations.			
14. SUBJECT TERMS  Benchmarking, Automotive training, Vehicles, Enlisted Training			15. NUMBER OF PAGES 248
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

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The purpose of this questionnaire is to determine the potential for current and future applications of AFIT thesis research. Please return completed questionnaires to: AFIT/LSC, Wright-Patterson AFB OH 45433-9905.

1. Did this research contribute to a current research project?

a. Yes

b. No

2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?

a. Yes

b. No

3. The benefits of AFIT research can often be expressed by the equivalent value that your agency received by virtue of AFIT performing the research. Please estimate what this research would have cost in terms of manpower and/or dollars if it had been accomplished under contract or if it had been done in-house.

Man Years \_\_\_\_\_

\$ \_\_\_\_\_

4. Often it is not possible to attach equivalent dollar values to research, although the results of the research may, in fact, be important. Whether or not you were able to establish an equivalent value for this research (3. above) what is your estimate of its significance?

a. Highly  
Significant

b. Significant

c. Slightly  
Significant

d. Of No  
Significance

5. Comments

\_\_\_\_\_  
Name and Grade

\_\_\_\_\_  
Organization

\_\_\_\_\_  
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